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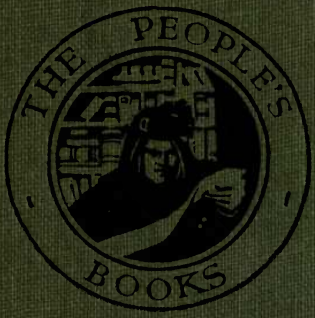

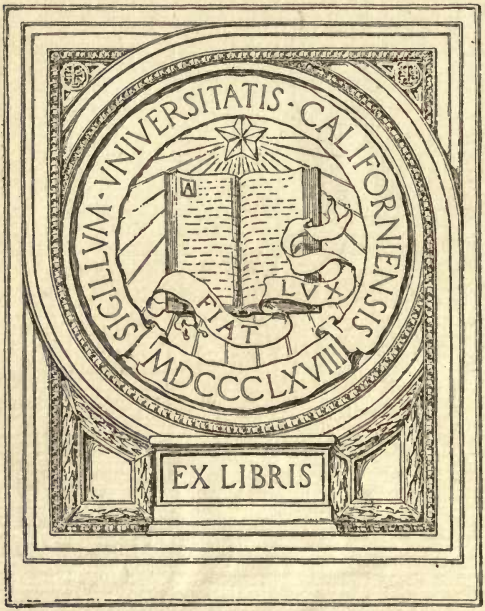
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VEGETABLE GARDENING

VEGETABLE GARDENING

BY

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VEGETABLE GARDENING

CHAPTER I.

SOIL MANAGEMENT.

THE basis of successful vegetable cultivation lies in the thorough working and preparation of the soil along the lines best suited to its texture and composition, coupled with adequate manuring according to the requirements of particular soils and crops. Soils are very variable, and in order to obtain the best results it is essential that each cultivator should have at least an elementary knowledge of the type of soil with which he is dealing, so that he may work and manure the soil to the best advantage, with due regard both to economy and efficiency, and at the same time realise to the fullest possible extent its natural resources. This does not in any way imply the depletion of the soil. On the contrary, if the methods of cultivation and manuring are conceived along right lines and efficiently executed in practice, the soil fertility becomes gradually built up and permanently increased, and this should be one of the chief aims in all soil operations.

Composition of Soils.—With the exception of black peaty soils, which are mainly of vegetable origin, all soils have been formed primarily by the accumulation of particles of mineral materials, consisting chiefly of sand and clay, along with other inorganic substances. And although these materials form the basis of all fertile soils, they are, by themselves, incapable of supporting plant life. It is only when they become mixed or enriched with organic or vegetable material in sufficient proportions, along with an adequate supply of lime, that the soil becomes really fertile and capable of producing heavy crops of the best quality.

It follows that the main ingredients in the composition of a good fertile soil are sand, clay, humus or organic matter, and lime. Further, these ingredients contain and are capable of providing in suitable form quite a number of substances required for the growth of crops.

Sand.—This consists principally of grains of quartz or silica, frequently coloured by the presence of oxide of iron. Sand does not cohere readily, and has the mechanical effect of keeping a soil free, porous, and well ventilated. It also absorbs and radiates heat quickly; consequently, soils containing a fairly large amount of sand are looked upon as warm soils, producing early and rapid growth and hastening the maturity of the crops.

Clay.—This consists of minute particles of alumina, quartz, and other minerals. Clay is very cohesive, wet, and cold, but when present in the right proportion it enables a soil to hold moisture and soluble plant foods; and although slow to warm up, once

warmed, clay maintains a more uniform temperature and prevents the rapid loss of heat from the soil during cold weather, and late into the autumn, owing to its poor conductive powers.

Humus.—The word "humus" is a general term, and includes the decayed remains of animal and vegetable matter of all kinds. This is the material which, when mixed with sand and clay, gives richness and fertility to the soil, and as decay proceeds the valuable ingredients it contains are liberated for the benefit of the crops. Humus also has the power of absorbing and retaining moisture and heat in a wonderful degree; it improves the texture of a soil, rendering it more friable and easy to work, and is the medium in which there lives an immense number of minute organisms so essential to the production of available plant foods.

Lime.—This is essentially a transitory substance constantly being removed by crops and percolating water, and absorbed by combination with acids from decaying vegetable matter, fertilisers, etc. Periodical dressings of lime are very necessary, but this will be fully discussed in the chapter on manuring.

Soils may be simply classified as a clay soil when this material predominates to any great extent; a sandy soil when sand is present in excess; a black organic soil when it contains an excessive amount of humus, as all peaty soils do, and sometimes, though to a less degree, old garden soils which have long been heavily manured; and as a loamy soil. Loam is the best kind of soil, being very fertile, easy to manage, and well adapted for the successful cultivation of vegetable crops. Loams vary somewhat in texture,

from a sandy loam to a clayey loam; but what might be termed a true loam contains the necessary ingredients in the following approximate quantities:

Sand	40 to 50 per cent.
Clay	30 to 40 ,, ,,
Humus (and Lime) . .	10 to 20 ,, ,,

Improvement of Soils.—Many soils fall short of the loamy condition so desirable for vegetable growing; but a good deal may be done to alter and improve the texture and composition of the soil, and so modify whatever faults it may possess as to bring it into a more friable and better balanced condition.

Light sandy ground is improved by increasing the humus in the soil, by means of liberal applications of the heavier kinds of farmyard manure and the addition of all available vegetable material; the digging in of turf, or soil of a heavy nature, and dressings of lime, which has a binding effect on loose sandy soil.

Peat soils are very unfavourable for gardening purposes. They are sour, more or less water-logged, and difficult to manage. Thorough draining, liberal and frequent liming, and mixing with mineral material, will in time improve them and render them more fertile.

Stiff clay soils may be altered and improved by digging or trenching in early winter and laying the soil up roughly to the action of the weather; draining to remove surplus water and allow air to penetrate freely; by digging in liberal quantities of strawy manure, leaves, and vegetable refuse; also by the addition of any sandy material of a free porous

nature, and periodical dressings of lime, which breaks up a stiff adhesive soil and makes it more friable.

Drainage.—Water-logged land is always sour, cold, and badly ventilated, resulting in stunted growth and late crops of poor quality. In wet weather surplus water should be able to pass freely downwards from the upper cultivated soil, and deep cultivation alone is often sufficient to secure this result. But should this not avail, and water stands on the surface, or the ground generally proves to be wet, draining must be resorted to. The distances apart of the drains and other details vary in individual cases, and must be determined by local conditions; but the drains should not be made deeper than 2½ feet, and the drain-pipes should not be buried in a stiff tenacious clay when it can be avoided. Rather fill in the drains, above the pipes, with ashes or stones up to the level of a clay subsoil, or to within 18 inches of the surface of the ground, to ensure that the drains will continue to draw well and be effective.

Some of the chief advantages of good drainage are: (1) the removal of surplus water; (2) more efficient and deeper ventilation; (3) a higher and more uniform soil temperature; (4) earlier and more rapid growth of crops; (5) increased returns are secured from manures; (6) better conditions are provided for useful bacteria.

Soil Bacteria.—The soil has an enormous population of very minute bacteria, or microbes, which are continually at work decomposing organic substances in the soil, liberating potential plant foods, and afterwards converting certain of these into a

form in which they become available to the crops. It is well to remember that all decay is the result of the vital activities of bacteria and fungi. If these did not exist there would be practically no decay and the earth would be cumbered with the dead remains of pre-existing forms, and long ere this all the available material would have been locked up. No new living things could have been formed. The bacteria and their allies come between the dead and the living, and enable material to be used over and over again, thus ensuring that the death and decay of what is gone should give the means of life to what exists. They perform a large and far-reaching share in converting the soil into nature's great storehouse of food to meet the wants of the world.

It is not possible here to follow up the subject in detail, but only to state briefly that the main place of bacteria in the economy of nature is to break down the complex compounds of animal and vegetable materials through an infinite number of changes, finally into such simple things as carbonic acid, water, ammonia, and free nitrogen. Speaking generally, the greater the amount of humus present in the soil the greater the number of bacteria; a rich garden soil contains very large numbers.

Bacteria are present in the greatest numbers a few inches below the surface. The surface soil itself is often too dry for their increase. Deep down there is too little food or too little air. But at a depth of about 4 to 9 inches they may be found at the rate of several millions in each ounce of soil, to state only a low estimate in general terms.

These facts should be kept in mind in all soil opera-

tions, and means taken to conserve and encourage this soil population; promote the activity of the various bacterial processes, and the increased production in the soil of available plant foods. In this connection one thing to avoid is burying the rich fertile soil in trenches and bringing to the top a comparatively poor, lifeless soil to take its place.

Digging Soils.—It would be difficult to overestimate the beneficial effects of deep, thorough cultivation, and laying the soil up roughly in winter to the action of frost and other weathering influences. Deep digging, and periodical double digging, should be the method of cultivating all vegetable ground, and on larger areas where ploughing is practised the subsoil plough should be freely used. At all times avoid working a heavy clay soil when it is in a very wet condition. Generally, stiff clay soils are better dug in late autumn or early winter, and sandy soils of a porous nature in early spring.

Digging consists of turning over the soil one spade deep, equal to 1 foot in depth. The area to be dug should first be divided into two or more sections of an even number, working along one half, or section, and back on the other. This method obviates the wheeling of soil from one end of the area to the other, which would be a waste of time and labour. The proper course is to open a trench 1 foot wide and a full spade deep across the end of the first half or section of the area as shown in Fig. 1. The soil removed from the first trench at 1 is placed in a heap across the corresponding end of the second half at 2; next dig along the first half to the other end (1 to 3), and fill the open trench there with soil from

the first trench of the second half at 4, working backwards and completing the work by filling the last trench at 5 with the soil first removed (2). In digging, the spade should be forced into the soil to its full depth and in an upright position, and each spadeful should be taken clean out and turned over

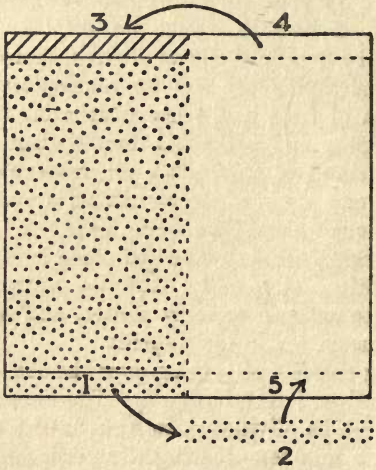

FIG. 1. Method to follow in Digging, and in Double Digging.

in its new position, always keeping a clear, open trench in front of the spade.

Double Digging.—This is often referred to as "bastard trenching," and means digging the ground two spades deep instead of one. The area should be marked off and the same direction followed as in ordinary digging. A wider trench, about 20 inches broad and 1 foot deep, should be taken out across

the end of the first section, placing the soil in a heap as before. This exposes the subsoil or second spade depth in the bottom of the first trench, and this subsoil should next be dug over or broken up thoroughly 1 foot deep, using a pick if need be. The top spade depth of soil from the second trench should then be turned over to fill up the first. Continue this process along to the end of the first half, and fill up the last trench there with the soil from the first trench of the second section; work back on this, and use the soil first taken out to level up the last trench.

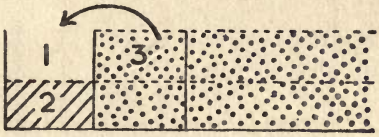

FIG. 2. Double Digging.

1. Top spade depth of 1st trench removed.
2. 2nd ,, ,, dug over in position.
3. Top ,, ,, of 2nd trench turned over on 2, to fill up the 1st trench.

This is the best system of deep-soil cultivation for vegetable ground generally, and when the work is completed the whole area has been stirred 2 feet deep. The soil and subsoil still occupy their former relative positions, the richer, more fertile surface soil with all that it contains is still retained on the top. (See Fig. 2.) When the surface soil is shallow, strawy manure, leaves, and vegetable refuse may with advantage be spread in each trench above the subsoil before filling in from the next trench with a view to deepening the fertile layer.

The good effects of double digging last for several years; but it is advisable, in order to get the best

results, that all vegetable ground be double dug every third or fourth year, and this is especially necessary and beneficial in the case of stiff clay soil. A good plan would be to work the vegetable garden, or allotment, in four sections, and double dig a section each year so that the work is spread over four seasons, the remainder of the ground being dug annually one spade deep. This ensures that the whole

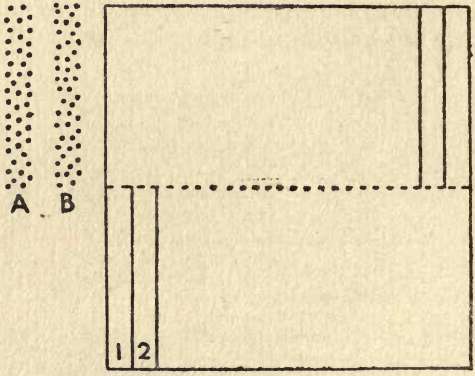

FIG. 3. Method to follow in Deep Trenching.
A. Top soil from trenches 1 and 2.
B. 2nd spade depth from the 1st trench.

area is cultivated 2 feet deep every four years continuously, and the deep-rooting vegetables should be grown on the section so treated the previous winter.

Deep Trenching.—If it is desired to cultivate a piece of ground, or prepare special beds for deep-rooting crops, by working the soil 3 feet deep, this is done by full, or deep, trenching. Mark off the ground as in the case of double digging, then remove

the top spade depth of soil from both the first and second trenches, and place it in a heap as before. Next take out the second spade depth from the first trench and place it in a heap beside the surface soil, but keep it separate. (See Fig. 3.) This exposes the third spade depth in the first trench, which is turned over and left in its former position; the second spade depth from the next trench is dug over on the top of it, and the first trench is then filled up by throwing forward the surface spade depth of soil

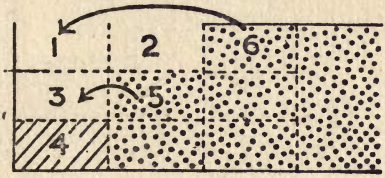

FIG. 4. Deep Trenching.

1 and 2. Top soil first removed.
3. 2nd spade depth also removed.
4. 3rd ,, ,, turned over only
5. 2nd ,, ,, from 2nd trench turned over on 4.
6. Top soil from 3rd trench thrown forward to take the place of 1 and fill up the first trench.

from the third trench. In this way the ground is worked three feet deep throughout without changing the relative positions of the soil layers, as indicated in Fig. 4.

Breaking in Fresh Ground.—When breaking in fresh ground for vegetable growing, double digging the area the first winter is the best method to adopt. If it happens to be grass land the turf should first of all be stripped from the paths and be dug in as the work proceeds. Grass paths are unsatisfactory, and

soon become unsightly and a constant source of trouble, besides harbouring wireworms and other pests. The ground should be worked two spades deep on the lines described under double digging, but with this in addition that the turf should be pared from the first trench in commencing the work, and be laid in a heap along with, but separate from, the surface soil. After turning over the subsoil pare off the turf from the next trench in each case, and turn it grass side down above the stirred subsoil, chopping the turf well up with the spade before throwing forward the surface soil on the top of it. In this way

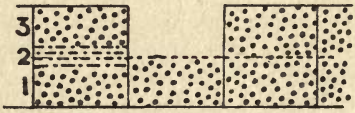

FIG. 5.

1. 2nd spade depth turned over in position.
2. Turf from 2nd trench, chopped up.
3. Top soil from second trench.

the turf becomes sandwiched in between the first and second spade depths of soil (see Fig. 5), where it decays and in after years is turned up and becomes mixed with the surface soil. The turf should be pared off very thinly, so as to bring into immediate service the good surface soil directly underneath it.

Surface Cultivation.—This should in all cases follow thorough winter cultivation, and should be regularly practised all through the growing season—the more frequently during periods of dry weather. Summer cultivation, or regular hoeing between the rows of crops, is too often neglected; and this is to be

regretted, as it is an operation of much greater importance than at first sight appears. Stirring the soil frequently to the depth of about 3 inches is excellent in every way and has many far-reaching and beneficial effects. It breaks up the more or less consolidated surface and admits air freely to the ground, which is a distinct advantage. A free and abundant supply of air is necessary to the healthy development of the roots; it is vital to the life and healthy activity of the many useful organisms in the soil; assists in the breaking up of materials, and is therefore an important factor in the production of plant foods.

It would be a mistake to assume that this admission of air makes the soil dry or less capable of retaining moisture. On the contrary, the stirring of the surface produces a thin layer of fine loose soil—however dry this layer may become it matters little—which acts like a mulch in dry weather, checks evaporation, and conserves moisture underneath for the benefit of the crops. In dry weather moisture is continually rising towards the surface of the ground by the capillary attraction of the soil, and if left unchecked a considerable amount would escape into the atmosphere by evaporation and be lost to the crops. Frequent hoeing of the surface soil prevents this loss, and by reducing evaporation heat is also better retained, its further absorption promoted, and the temperature of the ground maintained at a higher and more uniform degree. Incidentally, regular surface working ensures greater freedom from weeds.

CHAPTER II.

MANURES AND FERTILISERS.

THE use and application of manures for the purpose of increasing the fertility and productiveness of the land is an ancient custom, and was known in a general way to cultivators many centuries ago. Some of the writers who lived before the Christian era have left it on record that in their time various kinds of animal manures were used, and that when manures were scarce men turned in vegetable matter, and even sowed beans and vetches for digging in as manure.

Columella, who lived about two thousand years ago, in one of his writings deplores the backward state of cultivation, and tells of the deterioration of soils through neglect, and of the lack of knowledge of the requirements of crops. Virgil, in the *Georgics*, or *Art of Husbandry* (37 B.C.), is loud in praise of tares, vetches, pulse, and lupins for their manurial properties, and the enriching effects they have on the soil for the succeeding crops. But although the ancients recognised the value of pod-bearing plants as a preparatory crop, the secret or real cause of their fertilising power is a comparatively recent discovery.

Pliny (62 A.D.) has told us that lime, marl, and wood ashes were found to have a good effect on land. These records show clearly that some at least of the ancient cultivators knew of the fertilising value of vegetable and animal refuse, and probably even these early writers were not the first pioneers of the subject of manures and manuring. An old Roman maxim says that "the more you give to the land the more it returns to you," and this presumably had reference to the materials already indicated, for it is not until the seventeenth century, when saltpetre (nitrate of potash) was advised as a stimulant to the growth of crops, that we find any fresh substance being brought to notice as manure.

No clear conception of the elements of plant food was held until about the middle of last century, when by analyses and experiments conducted along scientific lines much valuable information was obtained and the foundations laid upon which a rational system of manuring has been gradually built up. The requirements of crops became known, and many substances now familiar under the name of "artificial" manures were brought freely into use. These substances have grown enormously in popularity as their properties and the remarkable results to be achieved by their use have become more generally recognised.

The substances required by crops are known from the composition of the ash of the various plants, and their relative importance in plant nutrition has been determined by minute and careful tests. These substances may be divided into :—

1. Essential or necessary, which include—

Phosphates, potash, lime, magnesium, sulphur, and iron, obtained from the soil; carbon, hydrogen, and oxygen, obtained from air and water; and nitrogen from both air and soil.

2. Less essential, which include—

Salts of sodium, silicon, chlorine, and manganese.

The functions performed by the substances included in the first group are well known, and although these materials are interdependent, they each operate in the building up of plant growth along fairly distinct and well-defined lines. The substances named in the second group are present in a smaller proportion in the ash of all crops, and, though they doubtless perform useful functions, these are less evident and are not so well understood.

Although all these materials enter into the economy of plant nutrition in a greater or less degree, it has been abundantly proved from practical experience, and by careful and extended experiments, that there are only four substances which require to be constantly added to the soil in manuring—namely, nitrogen, phosphates, potash, and lime, and these must be maintained in the soil in suitable proportions according to the special needs of the crops. The absence or insufficiency of any one of these components of plant food at once reduces the fertility of the soil, and is soon revealed in the reduced quantity and quality of the crops grown.

The Functions of Manures.

Nitrogen.—The general effect produced by the application of some single element of plant food is fairly well marked, and is a guide in determining what material should be applied or made to predominate in manuring individual crops. Nitrogen is the substance chiefly concerned in vegetative growth —that is, in the production of leaves, shoots, and stems —and it is the material to apply when a rapid or increased growth of these is desired, or when a crop lacks vigour and presents a stunted yellowish appearance. While it is necessary for all vegetables it is particularly beneficial to green crops, and to those that depend for their ultimate development on the production in the early stages of a strong, vigorous leaf growth. On the other hand, a predominance of nitrogen would probably be more or less injurious to certain vegetable crops—such as those grown for their tubers, bulbs, and seeds—the more so if the other plant foods were very deficient in the soil.

Phosphates.—These play an important part in the early development and root growth of young plants. They have the power to counterbalance the excessive absorption of nitrogen from the soil, and tend to promote a sturdy, firm type of growth. Phosphates are closely associated with the formation of tubers, flowers, fruits, and seeds. As phosphates are so important, and are usually lacking in soils, their liberal and regular use should be more generally adopted.

Potash.—This substance assists greatly in the development of thick, healthy leaf growth, and is

chiefly concerned with assimilation, and the production of starch, sugar, etc., in plants. It is especially beneficial to tubers, roots, fruits, and seeds, improves the quality and promotes early ripening and maturity.

Lime.—See under Fertilisers.

Organic Manures.

Farmyard Manure.—This is the oldest and most popular manure, and it is in itself a complete fertiliser, containing as it does the three most important plant foods, nitrogen, phosphates, and potash. These elements are present in varying proportions, according to the kind of feeding and age of the animals producing the manure, as well as to other conditions, the principal one being the care with which it has been treated. But, although it is a complete fertiliser, it is not well-balanced, as it is invariably richer in both nitrogen and potash than it is in phosphates, the latter being retained by the animals for the building up or production of bone, muscle, milk, etc. Farmyard manure is comparatively poor in phosphates; and the great bulk of soils, while they frequently contain a considerable reserve of nitrogenous material, are also deficient in this ingredient. To remedy this lack of phosphates, a general application over the whole area of a phosphatic fertiliser suited to the particular soil, as will be indicated later, and applied periodically, should be included in all systems of manuring if the soil is to be maintained in a properly balanced condition. Besides introducing plant foods directly, farmyard manure is of great

value in adding to the humus or organic matter in the soil, improving the texture of the soil, and increasing its water-holding and heat-absorbing powers. Moreover, the application of farmyard manure conveys to the soil immense numbers of useful bacteria, and afterwards, in decomposition, provides a suitable medium for their increase, and for their activities in breaking up crude materials and converting potential plant foods into a form in which the crops can make use of them.

When more than one kind of manure happens to be available, such as horse and cattle manure or horse and pig manure, or all three, it is better to mix them together in a heap, as they then give better results than when used separately. If it should be necessary for the manure to lie for any length of time in a heap it ought to be tramped or beaten fairly firm as the heap is made, and afterwards covered with a few inches of soil, in order to conserve the ammonia, an important fertilising ingredient which is converted into nitrogen in the soil.

Farmyard manure, if of good quality, should be applied to average soils at the rate of two to three barrow-loads to 30 square yards; about 1½ tons to an area of 300 square yards, or 20 to 24 tons per acre.

In the case of poor soils the quantity may be considerably increased; but for rich garden ground which has been heavily manured for a long period, and also in the case of a rich loamy soil freshly broken in from an old pasture, the turf being incorporated, rather less than the above quantities would be sufficient if supplemented by suitable fertilisers, particu-

larly phosphates. The manure should be spread evenly over the ground and dug in as early as opportunity offers. On heavy clay soils it is better to dig the manure in during autumn or winter, while light sandy soils are best dug in late winter or early spring, some time before the planting season begins. In the operation, the rough strawy portion of the manure should be pushed into the open trench as the work proceeds, and the short material turned over along with the top spade depth, so that it becomes mixed with the soil.

Poultry and Pigeon Manures.—This is a rich and valuable manure, but one that rapidly deteriorates if it is allowed to ferment, or is washed with rain. To avoid this loss it should either be kept dry under cover and be turned occasionally, or if placed in a heap outside it should be mixed with about an equal bulk of soil. If mixed with soil it may be applied at half the rate recommended for ordinary farmyard manure, but if used in its fresh, pure state at only a quarter of that rate.

Seaweed.—Where obtainable, this is an excellent manure and one frequently rich in potash. It is a good manure for potatoes and root crops, and from the quantity of salt it contains it is equally valuable for asparagus, cabbages, and other green crops. On light dry soils it may be applied at about the same rate as farmyard manure, while on heavy land half that quantity would be sufficient.

Wood Ashes.—When prunings and waste vegetable refuse are burned, the ashes provide a valuable fertiliser rich in potash. These should either be immediately applied to the soil, or be stored in a dry

place until required, as rain washes out the potash. The ashes are best applied on the rough surface of the ground after digging.

Soot.—Soot is chiefly valuable as a nitrogenous fertiliser. It stimulates growth, and has a beneficial effect on the soil. Soot should not be burned, as this would destroy its fertilising properties, and for the same reason it should on no account be mixed with lime when used as a fertiliser. It is best applied broadcast in early spring on the rough dug surface of the ground, and may be put on at the rate of 8 to 10 lbs. to 30 square yards, or 1 cwt. to an area of 300 square yards. Soot may alternatively be used with good effect later in the season as a top-dressing, when a light dusting only should be given at intervals, between the rows of crops, and hoed in. When used as a top-dressing, soot is better to be kept under cover for a few weeks before application, in order to render it harmless to tender plants.

The Compost Heap.—In a convenient corner of the garden or allotment a compost heap should be made in which to place vegetable refuse of all kinds, to become rotted down for manure and be returned to the soil at some future time. A good method is to remove to the sides a few inches of the surface soil from a piece of ground some four feet square, and into this small area place all leaves and coarse refuse from exhausted crops. The heap is best kept straight up at the sides and flat on the top, so that it may readily be added to above without encroaching on more ground than is necessary. At intervals, after a thick layer of vegetable refuse has accumulated on the heap, it should be tramped or beaten

well down, and covered with a thin layer of soil. All available tree leaves and other materials of manurial value should be added to the heap gradually during autumn and winter. It would be further improved by the addition of soot and wood ashes, and by utilising as far as possible house-slops and soap suds, which should be thrown over the heap.

The compost heap may be dug into the ground in spring, or be held in reserve for manuring ground that becomes vacant later in the season. An alternative is to retain the heap for a year and grow vegetable marrows on it during the summer. These succeed well when grown on a quantity of decayed vegetable material of this sort.

Fertilisers.

Lime and its Application.—It has already been stated that lime is a necessary constituent of all fertile soils. It is also a necessary constituent of plants, and these obtain it from the soil. Some of the benefits to be derived from lime in the soil are: (1) it promotes the decomposition of organic matter, and assists in the liberation of plant foods; (2) it corrects acidity, sweetens the soil, and improves the quality of growth; (3) it hastens the processes of nitrification; (4) it improves the physical character of the soil; and (5) it reduces, and in some cases eliminates, the danger from fungus diseases.

Lime benefits the soil and the crops in other directions, and its good effects might be considerably enlarged upon; but enough has been said to show that however well a soil may be manured in other re-

spects, it cannot be brought to a high state of fertility without the presence of an adequate supply of lime.

Lime should be applied in winter or early spring, on the surface of the ground after digging has been completed, and immediately raked into the surface soil. It should never be dug in, but should be kept in the surface soil as long as possible. Burnt lime, in a fresh caustic condition, may be obtained either in the form of ground lime-shell, which should be at once applied broadcast, or as shell-lime, which requires to be placed in small heaps on the land and covered with soil until it falls away to a fine powder, when it should be spread evenly over the ground. In either case lime may be applied to most soils every third year at the rate of 1 to 1½ stones to 30 square yards, or 1 to 2 cwts. to 300 square yards.

Ground Limestone.—Unburnt ground limestone, where more readily available and cheaper, may be applied at half as much again as the above rate.

Chalk.—Chalk or carbonate of lime may be applied at double the above quantities.

Gas Lime.—Apply at the same rate as ground limestone, in autumn or early winter, and leave exposed on the surface for several weeks.

Waste Carbide of Calcium.—When this is available it may be used at the same rate as chalk. This substance is better to be turned several times and dried under cover before being applied, so that it may be more evenly distributed and raked into the surface soil.

Nitrogenous Fertilisers.—Nitrogen can be applied directly in the form either of sulphate of am-

monia, nitrate of soda, nitrate of lime, or nitrolim; but for general garden work, provided the ground contains sufficient lime, sulphate of ammonia is most to be recommended. This, or any of the above fertilisers, may be used at the rate of about 1 oz. per square yard, 1½ to 2 lbs. to 30 square yards, 15 to 20 lbs. to 300 square yards, or 1 to 2 cwts. per acre.

Nitrogenous manures should not be applied as a general dressing during winter, but used as a specific dressing in spring for certain crops to be indicated later, either before sowing or planting, at the time of planting, or as a top-dressing to the growing crop.

Phosphatic Fertilisers.—These may be applied (1) in the form of basic slag at the rate of 5 lbs. to 30 square yards, ½ cwt. to 300 square yards, or from 6 to 8 cwts. per acre; (2) bone-meal, or steamed bone-flour, either separately or mixed together in equal proportions, and in each case applied at the same rate as the slag; or (3) in the form of superphosphate at the rate of 3 lbs. to 30 square yards, 2 stones to 300 square yards, or 4 cwts. per acre.

Basic slag is the best phosphatic manure for all medium and heavy soils, while the bone manures are better adapted to light sandy soils. These are best applied in winter after digging the ground, while superphosphate, equally suitable for any kind of soil, is better applied in spring before planting, or, being soluble in water, it may be used as a top-dressing during the growing season.

A general application of basic slag every third or fourth year, to all vegetable ground, is recommended,

and in the interval, applying in addition, specific dressings of phosphates for particular crops.

Potash Fertilisers.—Potash may be applied as sulphate, or muriate of potash, at the rate of 1 oz. per square yard, 2 lbs. to 30 square yards, 1½ stones to 300 square yards, or from 2 to 3 cwts. per acre.

Flue-dust, from blast furnaces, etc., provides a valuable source of potash, and when available this should be kept dry and applied broadcast on the dug surface of the ground.

In all cases fertilisers should be applied on the surface, and retained as long as possible in the surface soil. They should never be dug in or buried deeply. Certain fertilisers, if mixed before being applied to the soil, react chemically on one another, causing a loss of valuable ingredients, and in some cases spoiling the mechanical condition of the manure. It is better, therefore, to obtain and apply the fertilisers separately, so as to provide the ingredients most required to each crop, and at the same time avoid mistakes in mixing certain of these fertilisers together.

Crop Requirements.—It has been shown that although a combination of the necessary plant foods is essential for all crops, those food elements act in a marked degree along distinct lines. And as crops are grown for the particular parts of the plants that are utilised for food, the subject resolves itself into the question of how best to manure for the maximum development of those parts, consistent with good quality. The answer lies in supplying to crops in greatest abundance those food elements best calculated to influence growth along the desired lines, and

in withholding, or reducing, any material which, if present in undue proportion, would tend to nullify the good effects otherwise obtainable.

The above-mentioned fertilisers may be used in alternate years with farmyard manure, or they may be used to supplement light dressings of farmyard manure when an ample supply of that material cannot readily be obtained. It is, as already indicated, unnecessary in most cases to apply all three ingredients, especially in addition to farmyard manure; and the use of fertilisers should be on the following lines, applying them in the quantities already stated:—

Potatoes.—Apply phosphates and potash in early spring, and a light dressing of sulphate of ammonia at the time of planting if the soil is poor.

Peas and Beans.—Apply phosphates and potash only, either in early spring or immediately before sowing.

Cabbage Family.—Dress the ground in winter or early spring with phosphates, and apply sulphate of ammonia before planting, or later as a top-dressing.

Beet, Carrots, Parsnips, and Radishes.—Apply sulphate of ammonia and potash in spring before sowing, or top-dress with these later between the rows.

Onions, Leeks, Turnips, and Celery.—Apply phosphates and potash in winter or early spring, and sulphate of ammonia before planting or sowing. The latter may also be used later as a top-dressing.

Lettuce and Spinach.—These respond to an application of sulphate of ammonia to the soil before sowing, or as a top-dressing during the period of growth.

The Use of Salt.—If used in moderation, rough agricultural salt may with advantage be applied to all except stiff clay soils, and should be put on, after digging in winter or early spring, at the rate of 2 to 3 lbs. to 30 square yards. It is especially useful for green crops of the cabbage family, beet, and as a top-dressing for asparagus and sea-kale. Salt has certain manurial properties, but it is also beneficial on account of the chemical action it promotes in the soil, one effect being the liberation of valuable potash which might otherwise remain locked up in the soil and be unavailable to the crops. It also has a good physical effect on a dry sandy soil. It is better to withhold salt from stiff clay land because of the unfavourable mechanical effect which it has on soil of this nature.

Liquid Manure.—This may be made in a tub or barrel, varying the amount of solid material to suit the size of the barrel, but on the basis of 1 stone of poultry or sheep manure to about 40 gallons of water, producing a liquid which may be used with only a little further dilution for all established plants.

The manure is best placed in a sack, which should be suspended from a stick laid across the top of the barrel; it can then be plunged up and down occasionally to liberate and distribute the food materials. The barrel should be kept well filled with water, and the manure renewed at intervals of two to three weeks according to the quantity of liquid used. Liquid manure may be said to have this advantage, that it can be given very weak at first and gradually followed up in a slightly stronger degree as the plants become accustomed to it. Further, it presents to

the plants the food materials in an already dissolved and more or less available form. In all cases it is safest and best to use liquid manure in a very weak state, and apply it each time in sufficiently copious quantities to wet the soil thoroughly down to the lower roots.

CHAPTER III.

ROTATION, SOWING, AND TRANSPLANTING.

Rotation of Crops.—Before fertilisers are applied the ground should be marked off, mentally at least, for the various crops, and provision made for planting the latter in groups, and manuring them according to their special needs; in each case withholding the fertiliser least required if the ground was suitably manured for the previous crop and properly treated during the winter. Assuming this to have been done, there is no advantage, for example, in applying additional nitrogen to pod-bearing crops, phosphates to root crops, or potash to green crops.

In allocating the vegetable crops each year, attention should be paid to carrying out as far as possible a sound system of rotation, based on the food requirements of crops and the effects which the growth of each produces on the soil. This is an important factor for continued success in vegetable growing; and both general experience and special experiments prove that it is not good practice to grow the same kind of crop, or crops requiring the same manurial treatment, on the same ground year after year. This practice, if persisted in, causes far-reaching changes

in the chemical composition of the soil, and alters its behaviour with regard to the crop it carries. There must be a constant drain upon the soil resources along the lines of the special requirements of that crop, annually reducing to a minimum certain essential plant foods, while others accumulate to a wasteful and harmful degree.

Vegetables should be arranged in groups, and each crop, or group of crops, should be followed with one making somewhat different demands on the soil, and leaving it in the best condition for its successor. This is the fundamental principle in all rotation of crops, which, if carried out intelligently, will keep the soil in a better balanced condition, improve the quantity and quality of the crops, increase the returns from manures applied, and reduce the risks of attack by insect pests and fungoid diseases.

The following table, in which only the principal vegetable crops are included, will act as a guide in carrying out a system of rotation, and in applying fertilisers to particular crops :—

Group I. Crops requiring chiefly Phosphates and Potash.	Group II. Crops requiring chiefly Nitrogen and Phosphates.	Group III. Crops requiring chiefly Nitrogen and Potash.	Group IV. Crops requiring the three in more equal proportions.
Potato. Pea. Bean.	Cabbage. Brussels Sprouts. Cauliflower, etc. Lettuces.	Beet. Carrot. Parsnip. Radish.	Onion. Leek. Turnip. Celery.

Other, and less common, vegetables would fit into one or other of these groups, according to the nature

of the plant and the edible portion for which it is grown, which is a good guide to its manurial needs.

A small area might be worked in three sections: all the green crops being grown together on one section. and all the root and stem crops on another; the potatoes being all planted together, with the pod-bearing crops adjoining. The following year the green crops would be moved along to follow the pod-bearers and to some extent potatoes; and the root and stem crops would also follow potatoes and partly also green crops; while potatoes would succeed green crops and root and stem crops. This is assuming that a considerable part of the area is devoted to potatoes, as is usually the case.

A simple rotation of this sort, and which could readily be varied to suit the different quantities of particular classes of crops grown, would suffice in small gardens and allotments; but in larger gardens a more extended scheme might be carried out, on similar lines.

Seed Sowing.—To avoid failures and disappointment it is important that seeds of good quality be purchased, and from a reliable source, so that they will be true to name. The surface soil should be made very fine with the rake for seed sowing, whether in the seed-bed for transplanting later, or in the open ground when sowing where the crop is to mature. It is necessary to sow at the proper depths, placing small seeds near the surface and larger seeds proportionately deeper; and in all cases to sow slightly deeper than the average in a light sandy soil, and nearer the surface in a stiff clay. Thin sowing should be the regular practice, and afterwards early thinning

out, not only from an economical point of view, but in order to get strong, sturdy plants. The aim should be to obtain a strong, vigorous germination in the first instance, and later to avoid overcrowding, as that is ruinous to young plants.

Appended is a seed table showing the depths at which to sow in a medium soil, and the approximate quantities of seed required :—

SEED TABLE.

Kind of Seed.	Depth to Sow.	Quantity—Length in Drills.	Seed required per Acre.
Lettuce	¼ in.	¼ oz. to 140 ft.	1 oz. for 1,000 plants.
Parsley	¼ "	½ " 100 "	14 lbs. in drills.
Cabbage family .	¾ "	1 " 150 "	1–2 lbs. transplanted.
Onion	1 "	1 " 170 "	10–15 lbs.
Leek	1 "	1 " 180 "	5–7 "
Turnip	¾ "	1 " 200 "	4–5 "
Carrot	1 "	1 " 250 "	8–10 "
Parsnip	1 "	1 " 180 "	8–10 "
Beet	1¼ "	1 " 50 "	18–20 "
Radish	½ "	1 " 60 "	30 lbs. in drills, 50 lbs. broadcast.
Early Peas . . .	2 "	1 lb. to 65 "	4–5 bushels.
Late Peas . . .	2–3 "	1 " 80 "	3–4 "
Kidney Beans . .	2–3 "	1 " 170 "	2–3 "
Broad Beans . .	3½ "	1 " 50 "	3–4 "

Transplanting.—When transplanting young plants of all kinds the utmost care should be taken of the fine fibrous roots. The plants should be well watered in the seed-bed, or boxes, a short time before being lifted. Afterwards dig up and remove the plants carefully, so as to avoid undue breakage of

the roots, and retain as much soil adhering to them as possible. Avoid pulling them out of firm soil by the tops.

In the case of purchased plants, with the roots more or less dried in transit, a good plan is to "puddle" the roots before planting by mixing fine soil and water, in a hole made in the ground, to a fairly thick consistency, and place the roots in this for a time. They can then be planted with the wet soil adhering to the roots. This is especially beneficial when planting in dry weather and soil conditions.

Succession of Crops.—By sowing for succession is to be understood the succession of crops of the same kind of vegetable over as long a period as possible, or throughout the year. For example, it is unsound practice to have all the rows of peas coming to maturity at about the same time, when by adopting suitable varieties, and sowing at appropriate times, their usefulness might be continued over a much longer period. This applies in an equal degree to several other vegetable crops, and to carry it out economically and effectively would, in many cases, mean sowing a smaller quantity of seed at any given time.

The methods by which a succession can be secured will be stated later, along with the cultivation of the different vegetables.

Continuity of Supply.—This is in some measure a corollary of succession. In its broad application it means securing a choice of vegetables throughout the year, and relates to the succession of kinds of vegetables, instead of to successive crops or varieties of any particular kind. A plentiful choice of vege-

tables during the summer and early autumn is not sufficient. It should be possible during the late autumn, winter, and spring months to have a choice of at least some of the following: cabbages (savoys), brussels sprouts, broccoli, borecole, and leeks from the open ground; and beet, carrots, parsnips, onions, and swedes which were stored in autumn. Unfortunately this aspect of the subject is often much neglected, with the result that garden ground is not made to produce a full and regular contribution to the food supplies.

Direction of Rows.—It is important that the rows of all vegetable crops should run north and south, or as nearly so as possible, with a view to utilising to the utmost sun-heat and light. This arrangement has the effect of exposing a greater leaf surface and soil surface to the direct rays of the sun; of producing warmer soil conditions right through the growing season, owing to less shading of the ground between the rows—and this is a valuable factor in increasing the production of plant foods. It also promotes rapidity and quality of growth and early maturity in the crops, and conduces in a large measure to the success of any inter-cropping that may be carried out.

Inter-cropping.—This may be defined simply as the growing of two crops simultaneously on the same piece of ground. Much might be done in this direction in all gardens and allotments, provided that overcrowding is avoided, as this would be distinctly harmful, and would defeat the object in view.

The spaces between the rows of slow-growing main crop vegetables should as far as possible be sown

or planted with kinds of quick growth and early maturity. Combinations of tall and dwarf growing crops may also be made.

Suggestions will be given later as to methods of inter-cropping, and also as to the times of sowing and planting the intermediate crops.

CHAPTER IV.

THE CULTURE OF THE POTATO.

Botanical Name: *Solanum tuberosum.*
Natural Order: *Solanaceæ.*

THE potato is a native of South America. The history of its discovery and introduction into Europe is rather obscure, but it is believed to have been brought over by the early Spanish voyagers about the middle of the sixteenth century. They found it under cultivation in the west of South America from Chile to Colombia, and flourishing at various heights above sea-level. It was thence introduced by the Spaniards into North America; and from there it was brought to England—first, some say, by Sir John Hawkins in 1563, certainly ten years later by Sir Francis Drake, and again by colonists under the auspices of Sir Walter Raleigh, returning from Virginia in 1586. The plant was grown from this period on Raleigh's estate near Cork, and became known as a food in Ireland long before it was cultivated in England. Its valuable properties having become more generally known, the Royal Society in 1663 took measures to encourage its cultivation; but a long time elapsed before it was grown to any extent. To Scotland the potato was introduced in 1725, and

a few years later a labourer named Prentice gets the credit of being the first to plant it under field culture in the neighbourhood of Kilsyth; and so great was the success of his experiment that every farmer and cottager promptly followed his example and took up its cultivation. Since that period the prejudices which so long existed against the use of potatoes, both in England and Scotland, have gradually disappeared, and for many years past the potato crop has been regarded as a most valuable addition to the staple commodities of life, only second in importance to cereals.

Soil.—The potato succeeds in almost any soil, provided it be cultivated on right lines; but the best soils for this crop are those of a loamy to a sandy nature, and the worst are heavy wet clays or peat. The lighter, drier, and warmer soils produce larger and sounder crops of a better quality and flavour. However, with good drainage, and deep, thorough cultivation potatoes may be successfully grown on practically all kinds of soil.

The ground for potatoes should always be dug deeply in winter or early spring, according to its texture, and be laid up roughly to the weather for a considerable time before planting. The potato plant revels in a very free, friable condition of the soil.

Manuring.—Except in the case of rich garden soils, farmyard manure is necessary for potatoes if the best results are to be secured, and this should always be applied and dug into the ground in winter, so that it is mixed with the soil and becomes more or less decomposed before planting. Some of the food materials are then available to the crop in the

early stages of its growth, which is important, and is a factor in increasing the yield later. The old custom of applying the manure in the drills and planting the tubers on top of it is quite wrong for garden work, and should be abandoned. The excessive use of farmyard manure should be avoided, as it is apt to cause rank growth at the expense of the tubers and to predispose the crop to disease.

Experience has proved that a moderate application of farmyard manure, supplemented with suitable artificials, is the best line to follow in manuring potatoes.

For kinds and quantities to apply, see under FERTILISERS.

Seed Tubers.—In saving potatoes for planting the following spring, these require to be carefully selected from the best and strongest plants if the vigour and productive powers of the variety are to be maintained.

Potatoes for seed purposes may be selected when digging the crop in the ordinary way; but it is well to bear in mind, and this applies most to early varieties, that they are better to be secured before they become dead ripe in the soil. It has been abundantly proved that immature seed potatoes always give the best results, promoting in the next season earlier and more vigorous growth and an increased yield. It also encourages the earliest possible maturity of a particular variety. Only sound tubers, clean, and free from disease, should be kept for seed.

The *size* of the tubers is also important. Too small potatoes should be avoided for seed, nor is it

advisable or economical to use very large ones. Tubers approaching medium size are best: those from 1½ to 2 inches in diameter, planted whole, have generally proved the most profitable for this purpose.

Too small tubers have weak buds, which will in turn produce weakly shoots and a poor crop of inferior potatoes; while using large tubers as sets is at once wasteful, and these will not give a proportionately larger yield than medium-sized specimens. If, in special cases, a number of large tubers must be used as sets, these should be cut in two lengthwise so as to divide as equally as possible the strong buds situated at the crown end of each potato.

An old custom, still frequently met with, is that of greening seed potatoes by laying them out in the sun for some time previous to storing. It is sometimes claimed that this assists the ripening and keeping qualities of the tubers, but experience has shown that it neither does the one thing nor the other, and is better avoided. Greening potatoes, especially if it is done in bright sunshine and is carried to extremes, checks the proper development of the buds, and tends to retard growth the following spring. Further, it has no effect in assisting the keeping qualities of the tubers, for if they are sound and free from disease they will keep well when placed indoors at once without being greened; while, on the other hand, if potatoes are affected with disease no amount of greening will save them.

Storing of Seed Potatoes.—The most approved conditions for seed potatoes are quite opposite to those that apply to tubers for cooking purposes.

After being lifted and allowed to become dry in the open air, they should be placed direct into shallow boxes, and taken indoors. The boxes may be stood in any outhouse, loft, or unused room where the potatoes will receive as much light and air as possible while they are out of the soil, so long as they are kept safe from frost in winter. They will, however, come safely through a dangerously low temperature if the ventilators are closed and the atmosphere is quite still at the time, and, in very severe frost, they are covered with sacks or other protective material. The ends of the seed boxes should be made a few inches higher than the sides; they can then be piled one above another to any height, having thus secured that light and a free circulation of air can readily enter between them.

Sprouting Potatoes.—There can be no question as to the advantage of having well-sprouted potatoes for planting, provided the sprouting has proceeded along right lines. When the tubers have been exposed to the influence of light and air, they generally vegetate earlier and more vigorously, which is desirable, but care must be taken not to allow the sprouts to be drawn up into long white succulent, useless growths. When lifted in the autumn the potatoes may either be placed a single layer in each box, which is best, or, if storage accommodation is small, two or three layers in each box, until the beginning of the year; but at that time, whenever a variety shows signs of active growth, the tubers must be arranged in single layers and placed with crown ends up, so that the strong buds are fully exposed. They should then be kept in full light, so that there

may be produced close-jointed sturdy sprouts of a dark green colour, and each well furnished with rudimentary roots round the base and at the joints.

A good plan is to allow not more than two and three sprouts to each set; any over three may be removed before planting.

When to Plant.—Early and second early varieties should be planted from the middle to the end of March, though a few rows of an early sort may be planted sooner for summer use. Main-crop varieties are best planted at the beginning of April, and, if possible, all potato planting should be completed by the middle of the month, as it has been proved that early planting is conducive to the best all-round results, increasing the yield and promoting earlier maturity in the crop.

Distances for Planting.—Various distances at which to plant have been advised, and put into practice, with varying degrees of success. The distances are sometimes much too close, causing overcrowding of the plants and poor returns. On the other hand, they are often too wide, especially in the case of main-crop varieties, resulting in wasted ground between the rows and plants, and not infrequently a reduction of the total crop from any given area.

With due regard both to the welfare of the crops and economy of space, the following distances have from experience been found very suitable for garden purposes, and for the different varieties:—

Early varieties 22 to 24 inches between the rows, and 10 inches between the sets.

Second early varieties, 26 inches between the rows, and 12 inches between the sets.

Main-crop varieties, 28 inches between the rows, and 14 inches between the sets.

A good average depth at which to plant the tubers is 5 inches, 4 inches being deep enough in stiff clay soil.

How to Plant.—The ground having been dug and manured some time in advance, the first thing to do in commencing to plant potatoes is to level the surface with a rake. The line should then be placed in position for the first row, and an open drill 4 to 5 inches deep taken out with the draw-hoe, or a spade may be used if preferred. A number of drills may thus be made; the potatoes being afterwards planted in the drills at the proper distances apart, and covered in with the rake, leaving the ground level but not too fine on the surface.

Another good plan is to set the line, and, by means of a spade held with its back to the line, make holes 4 to 5 inches deep and at the required distances in the rows. The tubers are then planted in the holes and afterwards covered in, as in the first method. A variation of the second mode of planting is that in making the holes in one row the soil taken out is thrown into the holes in the previous row containing potato sets. In this way holes are formed in one row, and the tubers planted in the preceding one are covered in, all in one operation. It only remains to rake the soil level in finishing the work.

Either the open drill, or holes made with the spade, is a better and more expeditious method than dibbling in the tubers, as is often done, but which has many serious disadvantages and cannot be approved of.

The tubers should not be planted in an upright

position; but should in all cases be placed on their sides, with the buds or sprouts pointing along the drill and all pointing in the same direction, preferably northwards. This position of the tubers tends to delay the appearance of the plants above ground, which is often a distinct advantage in the event of late frosts; but what is of greater importance, it secures a greater length of stem below ground, and consequently a greater production of early roots on which the crop is formed later.

After Cultivation.—When the plants are well above ground, and the rows are distinctly seen, the soil should be cleaned if need be and made quite free from weeds, carefully forking out all perennial plants and removing them, as small pieces of root left in the ground are sure to grow and cause trouble later.

The ground should then be well forked and loosened between the rows, and to some extent between the plants, the full depth of the digging fork. The soil, however, should not be turned over, but allowed to fall back into its former position, so as to retain moisture and keep the moist soil along with the manure underneath instead of exposing it on the surface. Run the digging fork through any large clods to break them up, and then level the surface. This important operation provides the loose, free-rooting conditions which are so beneficial and natural to the potato plant, promotes rapid growth and a branching extension of the root system resulting in increased tuber formation. It also facilitates the earthing up of the rows later. In the case of stiff soils, a second forking between the rows a week or so before earthing up is advisable.

Earthing Up.—Early varieties that are soon through the ground are better to have some fine soil drawn up over the shoots in the early stages as a protection against late frosts. But the final earthing up of all varieties should be done when the plants are 6 to 8 inches high. This should be done with the draw-hoe, so as to form broad, well-formed drills with a good bulk of soil along each side. Drills of this sort are better able to hold moisture and heat, and later in the season reduce the risk of injury to the tubers through exposure to the air and to disease spores. Avoid making narrow drills that run up to a sharp ridge at the top. It only remains to keep the drills clean by hand weeding until the time arrives for lifting the crop.

Lifting and Storing.—Early varieties are usually lifted gradually for use during July and August; but as soon as they are quite ripe, and the shaws or haulm withered, they should at once be lifted and stored as a precaution against the inroads of potato disease. This also applies to second early varieties, which ripen in September, though it is advisable to leave them in the ground so long as they retain a fair amount of green foliage and the tubers are increasing in size and weight. They keep in better condition when well ripened.

Main-crop potatoes are lifted when ripe in October, early or late in the month according to the locality, the season, and conditions of growth in the crop. They have reached this stage when, on being rubbed, the skins of the tubers are found to be "set" and firm, or when the shaws are quite withered and can be pulled out easily without bringing any tubers along

with them. They are best lifted as dry as possible, and care taken to remove every tuber from the soil, even the smallest, as if left in the ground these are only a source of trouble the following season.

Potatoes may be kept in boxes or barrels, or even in sacks for a time, provided they can be stored in a cool, dark place indoors where they will be safe from frost. Failing facilities for thus storing potatoes, the only alternative is to place them in a pit "pie" or

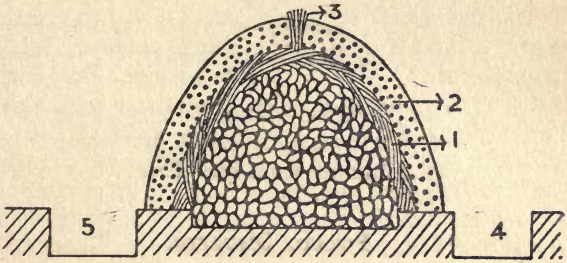

FIG. 6. Section of Potato Pit.

1. Straw covering on potatoes.
2. Soil.
3. Wisps of straw for ventilation.
4 and 5. Trenches from which soil covering has been taken.

"clamp" out of doors. In pitting, remove a few inches of soil and make a level, firm bottom for the pit; on this build up the potatoes to form either a cone or a wedge-shaped ridge about 30 to 34 inches broad at the base; cover the potatoes evenly about 6 inches deep with clean, dry straw, and on the top of this place 3 inches of soil, beating it fairly firm with the spade. Leave a portion at the top without soil for a time to provide ventilation, or introduce wisps of straw for the purpose. (See Fig. 6.)

Varieties.—The best varieties of potatoes to grow are those that produce heavy crops of sound tubers, and are at the same time of good table quality. The following may be selected as fulfilling these requirements, with this reservation, that certain varieties behave differently on different kinds of soil:—

Early Varieties.—May Queen, Midlothian Early or Duke of York, Ninetyfold, Harbinger, Sir John Llewellyn, Sharpe's Express.

Second Early Varieties.—British Queen, Edzell Blue, Macpherson, Burnhouse Beauty, King George, The Ally.

Main Crop Varieties.—King Edward, Great Scot, Arran Chief, The Lochar, Majestic, Abundance.

For varieties immune from wart disease, see page 57.

Potato Diseases.

Potato Blight (*Phytophthora infestans*).—This disease, caused by a parasitic fungus, is the one which commits so much havoc among the potato crop in wet seasons, and against which spraying with a fungicide is usually adopted as a preventive. The first signs of attack are the presence on the leaves of brown spots, which gradually increase in size and become darker in colour. In damp, sunless weather these diseased patches rapidly extend, until in a severe attack almost the whole of the foliage collapses and blackens, giving off an offensive odour. On examining the under-surface of an affected leaf a fine white mould may be seen, which consists of the spore-bearing or reproductive part of the fungus,

and the immense numbers of very minute spores, thus produced, are distributed from plant to plant and carried over a wide area by wind and other agents. In wet, dull weather the disease spreads rapidly; the spores also fall to the ground and are washed into the soil, where they reach, and subsequently infect, the tubers, causing them sooner or later to decay and become useless. Blighted tubers at first show discoloured rusty patches just visible through the skin, but more evident when the skin is scraped away. At first only a small part of the tuber may be attacked; but, later, the greater portion of it is affected, and, with the entrance of other destructive organisms to the diseased parts, a soft rot sets in which reduces the tubers to a pulp.

The disease is liable to be carried over from one year to another in the seed potatoes; and as those that are only slightly affected are easily overlooked, the greatest care should be exercised to select sound tubers from healthy plants in the first instance, and seed tubers should be carefully picked over later and at the time of planting.

Spraying Potatoes.—It is for the purpose of destroying the germinating capacity of the spores and preventing the disease from spreading or entering the tissues of the plants that spraying is resorted to. Potato spraying is more important in the south and Midlands of England, where the disease is more prevalent and liable to commence comparatively early in the season. In certain of those districts also, where disease appears early, it is advisable to spray second early as well as main-crop varieties. In the north of England and in Scotland spraying

can be dispensed with entirely most seasons, and even in a year particularly favourable to the disease it need only be applied to main-crop varieties. Generally, early varieties should not be sprayed; but if they are standing late in the ground, and are seen to be attacked by the disease, they should at once be lifted and stored before the tubers are affected. It is unnecessary to recognise any rule as to when spraying should be done, as this must be decided each season according to the weather and other conditions. In the south and Midlands of England the crop may be sprayed the first fortnight of July, giving a second spray about four weeks later; while in the north it is quite soon enough to spray at the beginning of August, spraying again, if considered necessary, three weeks later. There it has generally been found that if the weather during July and the first half of August is fairly dry, and sunshine abundant, spraying is quite unnecessary.

All spraying should be done when the foliage is perfectly dry, but not during very hot sunshine. The spray is best applied from below, upwards, in the form of a fine mist, and so as to wet both the under and upper surfaces of the leaves.

Spraying Mixtures.—Burgundy Mixture made as follows: 1 lb. copper sulphate and 1¼ lbs. washing soda in 10 gallons of water. Put 7 gallons of water into a tub or barrel and suspend a piece of sacking containing the copper sulphate under the surface of the water until it is quite dissolved, moving it about frequently; dissolve the soda in 3 gallons of water, and then pour this slowly into the copper solution, at the same time stirring constantly.

Bordeaux Mixture is made by using 1 lb. copper sulphate and $\frac{3}{4}$ lb. freshly burnt quick-lime in 10 gallons of water. Prepare as above, but it is necessary to strain the lime fluid through a piece of fine material to remove all gritty matter.

Larger quantities may be made on the same lines, but using the materials in the above relative proportions. Either of these mixtures should be used soon after being made, for they deteriorate by standing any length of time, and may become injurious to the foliage.

Wart Disease (*Synchytrium endobioticum*).—This is the most serious and destructive of all the diseases affecting potatoes, and when it finds its way into a locality, or a single garden, it becomes a menace to a large area. The disease gains an entrance at the eyes of young undeveloped potatoes, and there causes the growth of warty excrescences. One eye or several may be affected, but in late summer and autumn the diseased tubers become more or less covered with a rough warty mass and are rendered useless. (See Fig. 7.) The stems of the plants above the soil level may show the disease in the form of greenish-white outgrowths, and this is often the first indication of the presence of the fungus. (See Fig. 8.) At first the warts on the tubers are brown in colour and quite firm, but later they become almost black, and in autumn they turn quite soft and rot away. It is mainly when the last-mentioned stage is reached that immense numbers of spores of the disease escape into the soil, where they remain dormant but retain their power of infecting a potato crop for several years, and during all that time there is the constant

danger of the spores being spread over a larger area.

FIG. 7. Potato tuber showing the rough, warty growth.

When a first attack is discovered, the variety should at once be lifted, and refuse and diseased

FIG. 8. Potato stem warted above the surface of the soil.

tubers burnt on the ground to prevent as far as possible the escape of spores into the soil. Appar-

ently healthy tubers may be used immediately, and all peelings burnt. On no account should any be kept for seed. It must ever be kept in mind that the chief means of spreading this disease and introducing it to otherwise free soil is by planting affected tubers, and this requires to be closely watched when purchasing seed potatoes. No remedy has been discovered for the disease, except that of starving out the fungus by planting in diseased areas only immune varieties. This, fortunately, it is possible to do, and still obtain good crops. The following varieties, amongst others, have been proved immune from the disease:—

Early.—Resistant Snowdrop, Crown Jewel.

Second Early.—Edzell Blue, King George, The Ally, Burnhouse Beauty, Conquest, Mr. Bresse.

Main Crop.—Great Scot, The Lochar, The Provost, Abundance, Majestic, Rector, Kerr's Pink, Templar, Langworthy, Golden Wonder.

Corky Scab (*Spongospora subterranea*).—In its early stages this disease appears in the form of small conical or rounded elevations on the surface of young potato tubers. These warts are at first covered with the skin of the tuber, but soon become brown in colour and rupture the covering skin. (See Fig. 9.) After this stage is reached large numbers of spores are produced and set free, and in this way the soil becomes contaminated. If the disease remains limited to this stage, only the surface of the tuber is affected, and the damage for eating purposes is not serious. When, however, the disease assumes its severe form actual destruction of the flesh of the tuber takes place, producing a more or less cankered

condition in the potatoes. (See Fig. 10.) The spread of the disease and infection of soils is due mainly to the distribution and planting of affected tubers, and this must be carefully avoided.

FIG. 9. Corky Scab.

No effective method has been devised for dealing with contaminated soil. Potatoes affected with scab of any kind should preferably never be used

FIG. 10. Severe form of Corky Scab.
Tuber badly cankered.

for seed. Slightly infected seed, or seed which is not above suspicion, may be disinfected by steeping for three hours in a weak solution of commercial

formalin ($\frac{1}{2}$ pint of formalin to 15 gallons of water), or rolling the tubers when moist in flowers of sulphur. Certain varieties of potatoes have been found to be in some measure resistant to the disease and may be selected for cultivation in affected soil. These include: Ninetyfold, Harbinger, Edzell Blue, Macpherson, Burnhouse Beauty, King Edward, Arran Chief, Golden Wonder.

Common Potato Scab (*Oospora scabies*).—This is similar in appearance to Corky Scab; but as it is purely superficial, and does not affect the quality of the tubers, it may generally be ignored. The measures suggested against Corky Scab also apply to this disease.

Blackleg or Potato Stem Rot.—This insidious and destructive disease is so named because of the black colour produced in the decaying stems of affected plants, and which is accompanied by the wilting and withering of the leaves. The disease is of bacterial origin, and is caused by the presence in the soil of a bacterium called *Bacillus phytophthorus;* but as decay proceeds, various kinds of fungi, moulds, etc., assist in the destruction of the plants. The disease is most liable to occur during June and July, and spreads with greatest rapidity during hot, moist weather. Outbreaks are usually quite local, and in a plot of potatoes a few plants only may be affected. It is often difficult to discover the means by which the disease might have been introduced to the soil; but once there it is able to spread from plant to plant, and to combat it successfully it is important that diseased plants and those immediately adjoining be at once lifted entire and burnt. The ground

should then be tramped firm and planted with a green crop of the cabbage family. This ground should be marked and planted with a green crop for the following two years, as beans, turnips, root crops, etc., are also susceptible to attack.

Leaf Curl (*Macrosporium solani*).—Plants affected with this disease have curled, unhealthy leaves, are stunted in growth, and incapable of producing a satisfactory crop. No remedy is known; but if the following cultural points are attended to this disease is not likely to prove troublesome: (1) Where an outbreak has occurred the haulm and refuse should be collected and burnt to prevent the spores from infecting the soil; (2) Clean seed from a healthy crop must be secured; (3) Tubers for seed should be lifted before they are over-ripe: this is important, as potatoes that become very ripe before lifting are more liable to leaf curl, and this occurs most frequently amongst early varieties.

CHAPTER V.

THE CULTURE OF POD-BEARING CROPS.

The Pea.

Botanical Name: *Pisum sativum.*
Natural Order: *Leguminosæ.*

THIS plant was known and cultivated by both Greeks and Romans. It is not known in the wild state, and its native habitat is uncertain, but from a consideration of its historical distribution it appears probable that it originated in Central Europe or in Western Asia. It is supposed to have been introduced into England from France and Holland early in the sixteenth century.

Soil and Manures.—Peas can be grown successfully in any good garden soil, but give the best results in a deep, rich, loamy soil of a medium to a heavy nature. The soil should be deeply worked in winter, adding at the same time a dressing of farmyard manure. Light sandy soils require to be dug two spades deep, and have a liberal application of good manure incorporated in both the second spade depth and the top soil to within about five inches of the surface. The latter method may either be

applied to the whole area intended for this crop, or to special trenches where the lines of peas are to be sown. After digging, apply basic slag on the surface at the rate of 5 lbs. to 30 square yards, and in spring, before sowing the seeds, sulphate or muriate of potash, at the rate of 2 lbs. to 30 square yards. No nitrogenous fertilisers are required for this crop in a good soil. Peas and beans possess the remarkable power of being able to take up and assimilate the free nitrogen of the air. This they do through the agency of certain bacteria (*Pseudomonas radicicola*) which inhabit the nodules to be found on the roots. The bacteria take up the free atmospheric nitrogen, and manufacture it into nitrogenous compounds on which the plants then feed. Such an arrangement, whereby one plant or organism elaborates food for another plant with which it is closely connected, is called symbiosis (a "living together"). This source of supply, in addition to the nitrogen obtained from the soil and farmyard manure, is, as a rule, more than ample for the needs of the crops.

In this connection it may be pointed out that when rows of peas and beans are being cleared away, after the crop is exhausted, the plants should be cut over at the surface of the ground; the roots of these plants should not be pulled up, but allowed to decay naturally in the soil. The reason for this is that these pod-bearers, unlike other plants, have attached to their roots a quantity of small, but quite visible, nodules or swellings, each containing a large number of useful bacteria, along with a considerable amount of valuable nitrogenous plant food which they have been the means of producing. To pull these up

would be wasteful; while to leave them in the soil is at once economical, and is directly beneficial to the soil and to the crop that is to follow.

Sowing for Succession.—To secure a succession of crops of peas, several sowings must be made during the period from February to the end of June. If the soil and weather conditions are favourable, a sowing of an early variety may be made from the middle to the end of February, and, in timing subsequent sowings, as soon as the previous row is well through the soil another may be sown; or seed may be sown at intervals of two to three weeks in the case of dwarf varieties, and about four weeks for taller sorts. The first few sowings should be dwarf early varieties, followed by a taller main crop variety, while for the last sowings a good plan is to again use dwarf varieties.

How to Sow.—Dwarf peas should be sown 20 to 24 inches between the rows, and the taller varieties 3 to 4 feet apart according to their height. In small areas good results are got by using dwarf varieties only, right through the season, so as to economise space.

When sowing, first rake the ground level, then set the line, and with the broad part of the draw-hoe take out a broad flat-bottomed drill two inches deep. The drills are better to be slightly deeper for large seeded varieties, or in light sandy soils. Too thick sowing and consequent overcrowding of the young plants must be guarded against, as this is certain to be attended with poor results later. Scatter the seeds thinly in the drill, and after covering in with soil tramp lightly along above the seeds, or beat

with the rake held in an upright position, if the ground is not too wet. This consolidates the soil about and over the seeds, and promotes stronger and sturdier growth in the early stages, which benefits the crop later. Finish by raking the ground level. The first sowings of peas that are through the ground early in the season may have some soil drawn up along the sides of the rows temporarily as a protection against cold winds. This can readily be raked down later before the supports are placed in position. Generally, peas are best grown on the level soil, and no earthing-up practised. Earthing-up the rows is unnecessary, and in a naturally dry soil is distinctly objectionable.

In late spring and early summer, when sowing in dry soil and weather conditions, it is a good plan to soak the seed in water for about ten hours before sowing. This at once sets up the necessary chemical changes in the seeds, hastens the process of germination, and provides sufficient moisture to carry the young seedlings through the first stages until roots are formed to penetrate downwards into moist soil. Under dry conditions it promotes a more vigorous germination and results in stronger plants.

Staking of Peas.—Suitable branch stakes are undoubtedly the best where they are procurable, and these should be placed in position when the plants are only a few inches high, and inserted in such a way that a clear, open space is retained at the top, between the two rows of stakes. When branch stakes are difficult to get, stout canes or stakes may be inserted at wide intervals, and string stretched along the sides of the rows, twining it round the

stakes, placing the first string eight inches from the ground and adding others as growth proceeds. This answers admirably, especially for dwarf and medium height peas. Another method of supporting peas is to use 4-inch mesh wire netting 30 to 36 inches wide, which may be cut the length of the rows and be tied firmly to stout stakes, 2 inches square, driven into the ground 5 feet apart along each side of a row.

Later Treatment.—During dry weather the dutch hoe should be kept going frequently along the sides of the rows for the reasons already explained under surface cultivation. In the case of very dry sandy soils a mulch of manure, or lawn mowings, placed along the sides of the rows, is beneficial in keeping in soil moisture and heat. Peas should not be allowed to suffer from drought at the roots, and in the event of continued drought should be given a good soaking with water at the roots, afterwards using means to conserve the moisture. The taller main-crop peas are benefited by an occasional application of weak liquid manure, from the time the peas have commenced swelling freely in the pods onwards. Should dull or perfectly still weather prevail while the plants are in bloom, shaking them at the middle of the day will assist the pollenation of the flowers.

Gathering the Crop.—Peas are in the best condition for use when the pods are well filled, but still in a fresh green condition. The fullest pods should be taken at each picking, then the resources of the plants will be concentrated on the development of the younger ones. When a surplus exists, or a quantity of pods become over-ripe for immediate use late in the season, they may be allowed to become

quite ripe on the plants, and be pulled when in a dry condition; the seeds can then be removed and spread out to dry thoroughly, after which they may be stored away for future use. Dried peas only require to be soaked in water for several hours previous to being cooked.

Intercropping.—In connection with peas, double cropping can be practised from April onwards, provided the rows run north and south, or nearly so. Immediately a row is sown, mark off the distance to the next row to be sown a few weeks later, and midway between sow another crop, such as early carrots, early turnips, radish, lettuce, spinach, and turnip-rooted beet for early use.

The following is a selection of hardy, prolific varieties of peas :—

Dwarf varieties, up to 24 inches: Peter Pan, Sherwood, Little Marvel, Pioneer, English Wonder.

Medium height varieties, up to 3½ feet: The Pilot, British Lion, Peerless, Stratagem, Discovery.

Taller varieties: Royal Salute, The Gladstone, Buck's Royalty, Senator, Eureka.

Sugar Peas.—This is an edible-podded class of peas which deserves to be more generally cultivated in this country. The pods are cooked and eaten entire when the seeds are hardly formed in them, in a similar way to kidney beans. A dwarf-growing variety is best. They should be sown in April and cultivated on the same lines as ordinary peas.

The Bean.

The Broad Bean (*Vicia Faba*).—This plant would appear to have been originally a native of the East,

but it is not found wild anywhere now. In Europe the culture of the broad bean goes back to prehistoric times, and it was held in high estimation by the ancient Greeks and Romans.

The bean succeeds best, naturally, in a medium to a heavy soil, but can be well grown in sandy soils if liberally manured and means are employed to conserve moisture about the roots.

The preparation of the ground and manuring for this crop should be on the same lines as those outlined for the pea.

When and How to Sow.—A first sowing of an early variety may be made about the middle of February, and further sowings made once a month for succession up to May. Set the line and take out a wide flat-bottomed drill 3 to 3½ inches deep; plant two rows of beans in the drill 5 inches apart, and in each row the seed should be about 8 inches apart, planted alternately; cover in and firm the soil moderately above the seeds, afterwards raking level. A distance of 24 to 30 inches may be allowed between the double rows. Intercropping can be practised as recommended with peas, and when the beans have finished flowering and the pods are all set, pinch off the points of the plants two leaves above the uppermost pods, to prevent unnecessary top growth from being made, and place a check on the black fly which so frequently attacks the tender growing points. Hoe the surface of the ground regularly, and in an exposed situation the rows may be supported with stakes and string, as indicated for peas.

The following are good varieties for general garden purposes: Early Longpod, Early Mazagan, Ex-

hibition Longpod, Mammoth Longpod, and Green Windsor.

The Kidney or French Bean (*Phaseolus vulgaris*).—This was originally a native of South America, but not now to be found growing wild. It was introduced into Europe early in the sixteenth century, and is said to have been brought to England from the Continent about the same time. The kidney bean succeeds best in a warm, well-drained, and moderately light soil; cold clay soils and cold wet seasons do not suit this vegetable.

Dig the ground deeply in winter, working in a dressing of good farmyard manure. Afterwards apply basic slag and potash as recommended for peas, and in addition give a light application of sulphate of ammonia, 1½ lbs. to 30 square yards, either applied broadcast before sowing or later as a top-dressing between the rows when the plants are established and growing freely. The crop responds readily to this stimulant, especially in poor soils.

Times and Method of Sowing.—In large gardens several frequent sowings for succession may be made from the end of April to the middle of July, but in small gardens, or allotments, two sowings will suffice—the first during the second week in May, and the next sowing about the same time in June.

Drills 2 to 3 inches deep and 18 to 20 inches apart should be made with the draw-hoe, in which the beans should be planted singly, 10 to 12 inches apart. If the quality of the seeds is at all doubtful a safe plan is to sow 5 to 6 inches apart, and afterwards remove every alternate plant; they can also be transplanted to fill up vacancies in the rows. From the

time the plants appear above ground surface cultivate the soil, and if the ground is dry and porous a mulch of manure placed between the rows is beneficial. Give a copious watering whenever there is any risk of dryness at the roots. After the pods are set, weak liquid manure may also be given with advantage.

Good varieties are: Canadian Wonder, Evergreen, Ne Plus Ultra, and Magnum Bonum.

The Runner Bean (*Phaseolus multiflorus*).—This is a native of South America, and was introduced into this country in 1633. It was long cultivated chiefly as an ornamental plant, and it was not until much more recent times that it came into favour as a food plant. The runner bean is perennial when the roots are lifted in autumn and stored, to be planted out again in April. But the best results are got by planting seeds in spring and treating the plant as an annual.

Culture.—Prepare and manure the ground on the same lines as for peas. Sow early in May; set the line and take out a broad flat-bottomed drill 2 inches deep; in the drill plant two rows of beans 5 inches apart, and 8 inches between the seeds in the rows; cover in and then rake level. As soon as the plants are into active growth place supports or stakes, 7 or 8 feet high, in position on both sides of the row. Water when necessary, and give weak liquid manure occasionally after a number of pods are set.

Varieties: Scarlet Champion, Prizewinner, and Ne Plus Ultra.

Pests and Diseases.

Pea Moth (*Grapholitha pisana*).—The maggots of this insect are the cause of the "worm-eaten" peas

frequently found inside the pods. Insecticides are practically useless against this pest, but it may be suppressed by at once burning all affected pods and seeds as they are discovered, and as soon as the crop is gathered all pea-haulm should be collected and burned. Dig the ground in early winter, and afterwards apply a liberal dressing of quicklime, forking it into the surface.

Pea and Bean Weevils (*Sitones* sp.).—The adult weevils devour the leaves and shoots of young pea and bean plants, while the larvæ sometimes destroy the roots. The damage is often attributed to birds, etc.; as the weevils feed mostly at night and hide in the soil during the day they are not readily seen. Any of the following may be employed with good results, the object being to make the plants distasteful or poisonous to the pest: (1) Dust infected plants, when damp, with a mixture of lime and soot, or with hellebore or pyrethrum powder. (2) Spray the plants with a weak solution of arsenate of lead, or with an emulsion of paraffin and soft soap.

Bean Aphis (*Aphis rumicis*).—This pest is also known as the "Black Fly," "Collier," and "Black Dolphin." The insects appear, often in large numbers, on the tops of bean plants. When flowering is over remove the top of the plants, as advised in the culture of the bean, and if these are infested they should be burned. In the event of the pest attacking the plants before flowering is completed, or if it persists later on the lower leaves that are retained, syringe the plants with a strong solution of soft soap, to which may be added a quantity of quassia extract; or with dilute Clensel.

Pea Mildew (*Peronospora viciæ*).—This is a destructive disease when the attack is severe, covering the leaves with a fine white mould, which changes to a pinkish-gray colour, causing them to wilt and turn yellow.

Powdery Mildew (*Erysiphe polygoni*).—This disease appears on the leaves of pea plants in the form of yellowish blotches on the upper surface, while the under surface is covered with a whitish mildew which soon spreads all over the plants, including the pods. This disease, if unchecked, will kill the plants outright.

Either of these diseases injures the crop in proportion to the amount of mildew present on the foliage, and prompt measures should be taken to suppress them whenever they are detected.

Remedies.—Spray thoroughly with liver of sulphur (sulphide of potassium), at the rate of 1 oz. in 4 gallons of water, adding a little soft soap. Spray again ten days later.

For pea mildew, half-strength Bordeaux Mixture also gives good results. See BORDEAUX MIXTURE, page 54.

Those two diseases can only be carried over the winter in the form of resting spores, which are produced on the plants in late summer and early autumn. It is therefore very important that, as soon as the crop is gathered from infected rows, all leaves, haulm, and refuse should at once be collected and burned. Empty pods should also be burned as the crop is being used. A rotation of crops is also important.

CHAPTER VI.

THE CULTURE OF GREEN CROPS.

Cabbage Family.

Natural Order: *Cruciferæ.*

THE many varieties of cultivated cabbage, along with the savoy, brussels sprouts, cauliflower, broccoli, and curled greens belong to one species of the *Cruciferæ*, namely *Brassica oleracea*, and have been obtained entirely by selection. The wild plant from which they have been derived is indigenous to Europe and Western Asia, and may still be found on the coasts of England and France, and along the shores of the Mediterranean.

Cabbage (*Brassica oleracea capitata*).—The cabbage has been in cultivation from time immemorial, and was held in high esteem by the ancients. It is uncertain at what time its cultivation began in this country.

Soil and Manures.—The cabbage is not partial in regard to soil, and will succeed anywhere so long as the soil is rich or well manured. It, however, gives the best results, generally, in a good loam of a fairly close texture. Loose sandy soils require to be

made more compact by suitable manuring, and tramping firm previous to planting, to bring them into a good condition for cabbages.

For spring planting, the ground should be dug deeply in winter, and receive a generous application of farmyard manure. After digging, apply basic slag on the surface at the rate of 5 lbs. to 30 square yards, or, in the case of light sandy soils, substitute bone flour for the slag. If preferred, superphosphate may be used instead, provided there is plenty of lime in the soil, and applied at the rate of 3 lbs. to 30 square yards, before planting. In addition to a phosphatic fertiliser the crop is greatly benefited by a dressing of sulphate of ammonia at the rate of 1½ lbs. to 30 square yards, either applied shortly before planting or later as a top-dressing between the rows, when the plants are established. A light application of the latter may be given later in the season if considered necessary.

Times of Sowing.—By sowing suitable varieties at appropriate times it is possible to have a succession of cabbages coming into use over the greater part of the year. In many respects the most important sowings of cabbages are those made in late summer for autumn planting. To ensure a supply for cutting from spring till well through the summer it is better to make two sowings, in July and again in August, and plant out from these at intervals from about the middle of September to the end of October. In the north of England and in Scotland, sow about the middle of July, and again the first few days in August, and further south sow the last week in July and about the middle of August. An early,

hardy variety must be selected, such as M'Ewan's Early, Harbinger, Early Market, and Flower of Spring.

The next sowing should be made towards the end of August in the north, and the beginning of September in the southern counties, again employing a similar variety. The plants from this sowing are wintered in the seed-bed, and planted out in spring as soon as they are strong enough. Sow again in April, early in the month for the north, late in the month further south, a main crop and a late variety, for autumn and early winter use.

In addition to the above-named early sorts, the following varieties are excellent for main-crop purposes: Daniel's Defiance, Enfield Market, Mein's No. 1, and Winningstadt, a good late variety.

How to Sow.—The seed-bed should be forked over and raked very fine on the surface previous to sowing. Sow thinly in drills 10 inches apart and 1 inch deep, making the drills fairly broad and flat in the bottom, so as to avoid overcrowding of the young plants up to the time they are planted out; cover in the seeds, and if the soil is dry give a good soaking with water, afterwards protecting from birds with branches or a piece of netting.

Distances and Transplanting.—Early varieties planted in autumn should be 15 inches between the rows, and the plants 12 inches apart in the rows. Autumn-planted cabbages come in for use from spring onwards, at a time when this vegetable is most appreciated, and they continue to provide material for cutting throughout the greater part of the season. Another point in their favour is that they are less

liable to attack by the grubs of the root-fly than are those planted in spring; and, further, the bulk of them are cleared off the ground in time for another crop to be put in. These autumn plants should mainly succeed early potatoes, peas, beans, etc.; and after the ground is cleared of these, there is no need to dig and manure it, if it was well prepared for these crops. The best preparation for the cabbages is simply to clean the ground and then tramp it very firmly all over—this is especially necessary for loose potato ground—afterwards raking it level. Making the soil firm is important, as it encourages better rooting of the plants, produces firmer growth, which is more resistant to frost, and promotes the earlier and better hearting of the plants in spring. Having prepared the ground on these lines, shallow drills, about 2 inches deep and the full breadth of the hoe, should be drawn at the above-mentioned distance apart. Plant well down to the lower leaves, making the roots firm; and if the plants are placed along the centres of the drills, a certain amount of protection will thus be afforded them during severe weather. Apply phosphatic fertilisers in winter or early spring, and sulphate of ammonia after growth starts in spring, as already advised for this crop.

When planting cabbages in spring and early summer, from sowings made in autumn and in spring, similar lines should be followed. The ground having been winter dug and specially manured for this crop, it should be tramped previous to planting, in order to provide the firm rooting conditions so beneficial to this class of plant and place a check on excessive leaf growth. After levelling the surface, plant early

varieties in drills 18 inches apart and 15 inches between the plants in the rows. Main-crop varieties should be 24 inches between the rows and 18 inches between the plants. In transplanting cabbages, and other green crops, the plants should be carefully dug from the seed-bed, each with a ball of roots and moist soil, watering them first if need be. Plant, preferably with a trowel, in holes wide and deep enough to take the roots easily. The soil should then be made very firm around them.

Regular surface cultivation between the rows of cabbages and other green crops is very important, and if this is attended to they require very little further attention after they are into active growth.

Savoy Cabbage (*Brassica oleracea bullata*).—This plant, except in its wrinkled foliage, is very similar to the ordinary cabbage, and requires the same treatment as regards soil and manuring. It should also be raised and transplanted on the same lines. Sow about the end of April an early and a late hardy variety, and plant out in June on firm soil from which an early crop of some sort has been taken. Plant dwarf early varieties 18 inches between the rows and 15 between the plants; stronger-growing late varieties should be allowed 24 inches between the rows, and the plants 18 inches apart.

Dwarf Green Curled and Reliance are good dwarf varieties, while Ormskirk is an excellent stronger-growing sort. If a very large savoy is wanted, Drumhead may be selected.

Red or Pickling Cabbage.—Sow in March and plant out, 24 inches by 18 inches, when the seedlings

are strong enough, Red Dutch, or Dwarf Blood Red. Otherwise treat like ordinary cabbage.

Cauliflower (*Brassica oleracea botrytis*).—This is a cultivated variety of the wild cabbage, and is grown for its large metamorphosed flower heads. It is a vegetable of great antiquity, and its origin and distribution are uncertain. The cauliflower succeeds best in a rich loam that is fairly porous, though it can be well grown in most kinds of soil if suitably manured. The least favourable soil for its culture is a heavy wet clay.

For cauliflowers the soil should be prepared and manured in the same way as outlined for cabbages, and the raising of the plants, transplanting, and general cultural operations are practically the same.

Times to Sow and Plant.—Very early cauliflowers can be obtained only when cold-frame or glass-house accommodation is available for raising the seedlings and keeping them until it is safe to plant them out, or by purchasing plants, so raised, in spring. Sow seeds, about the second week in August in the north and early in September further south, in a well-prepared seed-bed out of doors; when the seedlings have made their third leaf, and are growing freely, transplant them into a cold frame, 3 to 4 inches apart each way, to stand during winter and be planted out in spring. Or, if preferred, sow thinly, broadcast, in the cold frames a fortnight later and allow the plants to stand where sown until planted out in spring. The former method is the better one. In each case select an early variety, such as Early London; cover with lights at the

beginning of October, but continue to afford ample ventilation in mild weather.

A sowing may be made in a heated glass-house early in February; transplant the seedlings early, into other boxes, 3 inches apart, and grow on in a moderate temperature; well harden off in a cold frame before planting out in April. Failing a heated glass structure, an early variety may be sown out of doors in March.

For an autumn and late crop sow suitable varieties out of doors towards the middle of April. Those raised in the open ground should be planted out when large enough, and at intervals, to secure a better succession.

Plant early varieties 18 inches between the rows and 15 inches between the plants; later sorts 27 inches between the rows, and the plants 18 inches apart.

Good varieties are: Early London, Early Forcing, Early Snowball. Main Crop: Walcheren, and Universal. Late: Eclipse, and Autumn Giant.

Broccoli.—This is simply a late, hardy type of cauliflower, suitable for winter and spring cutting. The broccoli prefers a deep, loamy soil, medium to heavy in texture. A poor, sandy soil is unsuitable for its cultivation. It requires the same cultural treatment as advised for cabbages and cauliflowers, but should be planted in summer on ground from which an early crop has been taken, planting in firm soil without further digging or manuring.

At the end of April sow early and late varieties to provide in succession winter and spring crops; plant out in June, 27 inches between the rows and 22 to 24 inches between the plants.

Good varieties are: Christmas White, Snow's Winter White, Knight's Protecting, and Late White.

Brussels Sprouts (*Brassica oleracea gemmifera*).—This vegetable is believed to have originated in Belgium, where it has been grown for many centuries, principally in the neighbourhood of Brussels, from which town it derives its name. It is an excellent vegetable, and one of the most useful members of the cabbage family.

For early sprouts sow in a sheltered seed-bed out of doors about the middle of August, the plants to stand in the bed all winter and be planted out in spring.

For winter produce sow the first week in April, and make two or three plantings from the bed in May and June; the last plants to be put out may succeed an early crop of some kind. Brussels sprouts may also be planted between the rows of early dwarf-growing potatoes, where the area is limited, and as the latter are dug and the ground levelled, this amounts to an earthing-up of the plants. Plenty of space must be afforded this crop, and overcrowding avoided; allow 32 inches between the rows, and 24 inches between the plants in the rows. Otherwise apply the same manuring and cultural treatment as that described for the cabbage crop.

The following are first-rate varieties: Dalkeith Selected, Matchless, Craigo, Solidity, and Aigburth.

Borecole, Kale, or Curled Greens (*Brassica oleracea acephala*).—This is an excellent vegetable for use during winter and spring when other green vegetables are scarce, and one that is worthy of a place in all gardens. Its cultivation is simple, and

its period of usefulness can be extended over a long period by using, first, the side leaves; next removing, as they are required for use, the rosettes of leaves from the tops of the plants, along with a small portion of the stems. This causes the plants to send out lower down a large number of side growths in the form of clusters of leaves which are even finer than those first produced.

The cultivation is the same as for cabbages, bearing in mind that the plant responds to a nitrogenous fertiliser applied twice during the season. Sow at the end of April and plant out in June in firm soil, 27 by 18 inches apart. Borecole may also be planted between the rows of early potatoes or between the rows of late-sown dwarf peas, the "Tall Curled" variety being best for this purpose.

Varieties: Dwarf Green Curled, Tall Green Curled, and A1.

Lettuce (Botanical Name: *Lactuca sativa*. Natural Order: *Compositæ*).—The lettuce is a hardy annual whose origin is uncertain. It has been cultivated in eastern countries from very early times, and it is supposed to have been introduced into England early in the sixteenth century. Lettuce is chiefly used as a salad, but it is excellent also when cooked as a vegetable.

Culture.—Lettuces make the best growth in a medium soil that is rich in humus. The ground should be dug and manured as advised for cabbages and other green crops, and receive the same fertilisers. The two types, Cabbage and Cos Lettuce, require the same cultural treatment. Seed may be sown in a seed-bed in August on a sheltered border; thin

out when strong enough, and transplant a number of the thinnings to a cold frame, 3 inches apart, to stand the winter and be planted out in April. Sow in a box under glass in February, transplant into other boxes, and grow on in a moderate temperature; harden off and plant out in April. Sow in the open in March, and every four or five weeks for succession up to the end of June. The seed should be sown very thinly in shallow drills 1 foot apart, and the plants thinned early to 8 inches. The thinnings should be carefully lifted and transplanted into any vacant ground that may be available, or between the rows of peas and other vegetables.

Cabbage Varieties: Sutton's Favourite, All the Year Round, Commodore Nutt, and Wonderful.

Cos Varieties: White Heart, Peerless, Paris White, and Paris Green.

Pests and Diseases.

Cabbage White Butterflies (*Pieris* sp.).—These well-known insects lay their eggs on the leaves of cabbages, and the caterpillars which hatch out devour the foliage. In a severe attack the plants may be rendered quite useless. There are two broods in the season, and the second, which appears in August, is often the most destructive. The insect passes the winter in the pupal stage, under rubbish or in the soil.

Treatment.—No poisonous spray is permissible on these plants. Hellebore or pyrethrum powder may be dusted over the leaves, when damp, but these must not be used within three weeks of the vegetables' being cut for eating. If young plants are attacked,

finely-powdered lime dusted over is beneficial. When the plants are hearting in, or approaching maturity, the safest and at the same time efficient remedy is to dust fine table salt freely over the leaves and the centres of the plants when they are moist.

Cabbage Moth (*Mamestra brassicæ*).—The caterpillars of this pest feed on the leaves, and also bore their way into the centres of the cabbage and cauliflower, the late summer and autumn crops being most attacked.

Apply the same treatment as for Cabbage Butterflies. In both cases hand-picking the caterpillars is excellent.

Cabbage Root Fly (*Phorbia brassicæ*).—This is the most destructive pest of the cabbage family, and the most difficult to combat successfully. The eggs are laid in the soil close to the stems of the plants, and the maggots which hatch out crawl down and destroy the roots, afterwards tunnelling into the soft tissues of the stems. There are two or three broods in the year, and the winter is passed in both the pupal and larval state in the soil and at the roots of cruciferous plants. Affected plants assume an unhealthy colour, and on being uprooted a number of maggots may be seen at the base of the stem. These plants should be carefully dug up and the grubs destroyed.

Treatment.—Insecticides are of no avail once the plants are attacked, and the main thing is to prevent egg-laying in the first instance. As far as possible planting cabbages in autumn, for succession, should be practised, as these plants are more resistant the following season than the spring-planted ones. When

planting any of those green crops in spring and early summer make the soil firm, and before setting out the plants puddle their roots in a thick mixture of soil, soot, and water, with a liberal amount of fine sulphur powder stirred in. Another preventive measure is to spread on the surface of the ground, particularly round the plants, soil or sand mixed with paraffin, carbolic, or creosote, or spent carbide of calcium used alone. These things must be applied immediately after planting. A device that has been fairly successful is to place round each plant a tarred felt disc at the time of planting. The discs are about 3 inches in diameter and have a slit from edge to centre to allow of their being placed round the stems; a number of short slits at the centre accommodate the stems and allow for growth. Where these are used, the planting is perhaps best done without drills and the discs pressed down close to the soil.

Club Root (*Plasmodiophora brassicæ*).—This disease, known also as Finger and Toe, and Anbury, attacks all plants belonging to the cabbage family, turnips, radishes, etc., and often proves very destructive. It is caused by a minute organism, the spores of which are able to live in the soil for a number of years in a dormant condition, ready to attack any crop of this family that may be sown or planted there. The disease is very infectious, and though it cannot spread through the air, it may soon be distributed in the various soil operations and in farmyard manure unless care is taken to restrict it. Affected plants show distorted, malformed roots which, in a severe attack, are rendered useless. The swollen portions decay later in the season and liberate large numbers

of spores, which further contaminate the soil. It thrives in an acid soil, and is decreased by an ample supply of lime.

Treatment.—(1) On removing an affected crop, all roots and diseased material should be collected and burned; (2) avoid, if possible, growing a cruciferous crop on the same ground for a few years; (3) after digging the ground apply a heavy dressing of freshly-burnt lime, at double the rate recommended for ordinary purposes; the following year dress heavily with basic slag, and the year after give a normal application of lime.

CHAPTER VII.

THE CULTURE OF ROOT CROPS.

Beetroot.

Botanical Name : *Beta vulgaris.*
Natural Order : *Chenopodiaceæ.*

THIS excellent vegetable is said to have been in cultivation for 2,500 years, and is a cultivated form of the wild beet, *Beta maritima*, which may be found on the English coasts and by the shores of the Mediterranean. The cultivated beet is believed to have been introduced into England in 1548.

Soil and Manuring.—Beet prefers a deep, free soil, medium to light and sandy in texture, and a sunny, open position. Although it will grow, sometimes very rank, on heavy clay soils, the quality is usually poor and the roots lacking in flavour. The soil should be worked deeply in early winter and laid up roughly to the weather, so that a fine "tilth" may be secured for spring sowing.

No farmyard manure need be dug in for beetroot unless the ground is very poor, when short or well decayed manure may be used, mixing it well with the soil. The better plan is to manure the ground well for a previous crop, such as potatoes, and then dig in winter without farmyard manure. After

digging, apply lime if necessary; and in spring give an application of potash and a nitrogenous fertiliser, raking them into the surface soil: 2 lbs. muriate or sulphate of potash, and 1½ lbs. sulphate of ammonia to 30 square yards. This crop also responds to a dressing of common salt, applied at the rate of about 2 lbs. to 30 square yards in early spring.

When to Sow.—There are two forms of beet-root: the turnip-rooted and the tapering-rooted. The latter is the best for main-crop purposes and for storing; but the turnip-rooted kind grows more quickly, and a quantity of this may be sown for use in summer and early autumn before the main crop has reached maturity. For this purpose seed may be sown early in April, and the roots pulled as required for use from the time they become large enough; they should not be allowed to stand late into the autumn, or they will turn coarse, and a number would probably run to seed. This kind of beet may also be sown as an inter-crop between the rows of peas and other crops. The main crop of tapering beet should be sown towards the end of April, but in some districts the beginning of May is found to be soon enough.

How to Sow.—The so-called seed of this vegetable is in reality a fruit with a very hard husk containing a number of seeds, each one therefore being capable of producing a number of plants, and which accounts for beet seedlings usually appearing in small clusters. The seed retains its germinating power for about six years, and many growers prefer two year old seed to one year old, claiming that it gives better results. Owing to the thickness and hardness of the husk,

and the varying degrees of hardness in individual seeds, beet germinates slowly and often very irregularly. To obviate this, it is a good plan to soak the seeds in water for two days previous to sowing. The water should then be drained off and the seed spread out on a piece of damp cloth or sacking for a day or so to become surface dried, so that it may be more easily handled. This soaking promotes a more rapid, uniform, and stronger germination, and is conducive to all-round better results. When sowing, the ground should first be raked quite level and made fine on the surface; drills rather more than 1 inch deep should be drawn, and 12 to 14 inches apart. Sow the seeds very thinly along the drills, or place three seeds, with a short space between, at intervals of 7 inches along the drill, this being the distance to which the plants have to be thinned later. The continuous row is most satisfactory, provided they are sown thinly enough. Cover in with a rake and leave the surface level.

Thinning.—When the seedlings are strong enough thin to 7 inches apart. The tendency of the seeds to produce closely-set tufts has already been indicated, and these must be carefully reduced to single specimens. After thinning, a watering given to the rows will at once settle the soil about the roots and enable the plants to become rapidly re-established. This is especially beneficial when the ground is dry at the time.

During summer hoe the soil frequently between the rows.

Lifting and Storing.—Beetroot should be lifted at the end of October, as it has then reached maturity,

and would be liable to deteriorate if left too late, especially if exposed to much frost. Lift very carefully with a spade, so as not to bruise the roots in any way, which would cause them to bleed and lose colour. For the same reason twist off the leaves close to the crowns instead of cutting them, and afterwards store the roots intact. They may be stored in boxes, or on the floor of a cellar or outhouse amongst sand or fine soil—alternate layers of roots and sand. On a large scale beet may be stored in pits, like potatoes.

The following are first-rate varieties: Globe, and Egyptian Turnip-rooted; and for main crop: Nutting's Dwarf Red, Dobbie's Purple, Pragnell's Exhibition, and Galloway Purple—a new non-bleeding variety that may be cut in two before cooking without losing colour.

Carrot.

Botanical Name: *Daucus Carota.*
Natural Order: *Umbelliferæ.*

The cultivated forms of this vegetable have been obtained by selection and cultivation from the wild carrot, which grows abundantly in some parts of this country. Carrots are said to have been first introduced into England by the Dutch about 1558. Like beet, the carrot contains a considerable quantity of sugar along with other valuable ingredients, and these are stored mainly in the outer red portion of the root; hence the wider this is, as compared with the yellow central portion, the higher is their nutritive value. The depth of this red portion depends

in some measure on the variety, but also to a great extent on good cultivation and suitable manuring.

Soil and Manuring.—Carrots require for their best growth a deep, sandy, warm soil. Cold clay soils are unsuitable for this crop, but a section can be specially prepared for it by removing a portion of the subsoil when trenching, and adding on the surface a proportionate amount of sand or light soil, forking it well into the top spade depth. The preparation of the soil and manuring for carrots should be on the same lines as advised for beet.

When to Sow.—For summer and early autumn use sow early Shorthorn carrots from the beginning of March onwards for succession; 9 inches between the rows, thinning the plants to 3 inches apart when they are strong enough to handle. These early carrots may also be used for inter-cropping between the rows of peas, beans, late cabbages, and other crops. Main-crop carrots are best sown the first week in April, or even towards the end of March if the soil and weather conditions are favourable.

How to Sow.—Carrots should be sown in soil which has been thoroughly forked over and made fine on the surface to the depth of a few inches. Rake level and draw drills 12 inches apart and 1 inch deep; afterwards sow very thinly and cover in, leaving the surface quite level.

Thinning and After-culture.—Early thinning is very important for this crop. As soon as the seedlings are well into the rough leaf thinning may commence, and they should be thinned gradually until the plants stand at 4 inches apart for main-crop varieties. The distances for early varieties have

already been given. Hoe frequently between the rows, and suppress all weeds, until the foliage covers the ground, when it may be discontinued.

Lifting and Storing.—At the end of October lift main-crop carrots and prepare for storing by cutting off a thin paring from the tops of the roots, in order to remove the buds along with the leaves, and so prevent growths being sent out after they are stored. Store in the same way as recommended for beet.

The following are good varieties: Early French Horn, Early Scarlet Horn, and Early Gem; main crop: New Red Intermediate, Altrincham, and Long Red Surrey.

Carrot Fly (*Psila rosæ*).—This insect lays its eggs on the carrot roots at the surface of the soil, and the resulting maggots bore into and feed on the tap roots, ultimately killing the plants. The first indications of attack are the leaves becoming a reddish, or yellow colour, and the arrested growth of the plants. Infested plants should be at once dug up and burnt. The pest can be successfully combated only by preventing egg-laying, and there is no single method or substance whereby carrots can be insured against attack. It is rather in the cumulative effect of a series of good cultural operations, combined with appropriate preventive measures persistently applied, that the safety of the crop lies. In infested areas very early sowing is important, even at the risk of a number of plants running to seed. Thin early, and then water the soil close in to the roots; afterwards place a mulch between the rows of lawn mowings or horse manure, 2 inches deep, keeping

the material as close to the seedlings as possible without smothering them. In place of, or better still in addition to, the mulch, dust the plants frequently during June and early July with soot which has been exposed to the air for some time; or spray the carrot bed frequently with paraffin emulsion, or with dilute carbolic disinfectant, to maintain a strong smell about the plants. If preferred, paraffin or carbolic may be mixed with sand or soil and be sprinkled between the rows.

Parsnip.

Botanical Name: *Pastinaca sativa.*
Natural Order: *Umbelliferæ.*

This vegetable is simply a cultivated form of the common wild parsnip which is indigenous to Britain. It appears to have been in cultivation before the Christian era, and was held in high esteem by the Romans because of its sustaining properties and high dietetic value.

Soil and Manuring.—The parsnip can be grown successfully in any good garden soil, but may be said to prefer a deep medium loam. Prepare the ground and manure as recommended for beet, but before applying the fertilisers in spring fork over the top soil once or twice to bring it into as fine a condition as possible.

Sowing and Thinning.—In the south and Midlands of England the crop may be sown early in March; farther north, towards the end of the month is soon enough. Level the ground and draw drills 15 inches apart and 1 inch deep. Sow thinly

in a continuous row, or deposit three or four seeds every 8 inches along the drill. The latter method answers well for parsnips; it economises seed and reduces thinning, while providing an abundance of plants if the seed is of good quality. The seeds retain their germinating power for two years. After the seedlings are well through the soil and growing freely, thin them to single specimens at 8 inches apart.

An inter-crop of early carrots may also be taken from the ground, sown at the same time as the parsnips and midway between the rows.

Lifting and Storing.—Parsnips are very hardy, and keep in excellent condition if left in the ground to be dug up as required for use. It is, however, a mistaken belief that the roots are improved by frost, for if lifted in autumn and properly stored, so that they will not shrivel, they are at least as good as those which have been frozen. If preferred, the roots may be lifted in November or December, and be prepared and stored like carrots, using moist soil for the purpose. A good method is to dig a deep trench in the garden and place the roots in this, in a more or less upright position, and cover them with soil, tramping it fairly firm; they may be trenched in, in alternate layers of roots and soil.

Good varieties are: Tender and True, Student, and Hollow Crown.

Radish.

Botanical Name: *Raphanus sativus.*
Natural Order: *Cruciferæ.*

The radish is one of the oldest of our vegetables, having been cultivated for many centuries in Asia

and Western Europe. It is not known in the wild state, and its origin is doubtful. It is supposed to have been introduced into this country about 1548.

The radish prefers a medium to light soil, rich in humus, and to obtain tender roots of good quality a rapid, continuous growth is necessary. Dig the ground deeply in winter, working in a liberal dressing of decayed manure, applying in spring the fertilisers recommended for beet.

Sow in early April, and frequently for succession during spring and summer, in drills 6 inches apart and ½ inch deep. The seed should be sown thinly, and after covering in make the soil firm above the seeds, afterwards thinning the seedlings to about 1 inch apart. They are further thinned as they become fit for use.

Good varieties are: French Breakfast, Long Scarlet, and Chartier.

CHAPTER VIII.

THE CULTURE OF BULB AND STEM CROPS.

Onion.

Botanical Name: *Allium cepa.*
Natural Order: *Liliaceæ.*

THE onion is said to be the cultivated form of a plant which grows wild in Afghanistan and Western Siberia, and its culture and use date back to a very remote period of antiquity.

Soil and Manures.—This plant succeeds best, naturally, in a deep loam, medium to moderately heavy in texture and rich in humus or decayed manure. If a soil is far from answering to this description, special measures must be taken to improve it when preparing a section for onions. The onion is a deep-rooting plant, and requires a deep, moist root-run for steady continuous growth throughout the season. The ground should be double dug in early winter, laying the top soil up roughly to the weather, working in at the same time a liberal amount of good farmyard manure, so that it may be well decayed before planting in spring. Poultry and pigeon manure are the best for this crop, but, failing

these, cattle or pig manure, or the two mixed, come next, and are better than strawy material from stables. If the manure is decayed before applying it so much the better. Bury a portion of the manure under the top spade depth of soil, and turn in the remainder along with the top soil so that it becomes mixed with it. After digging apply basic slag on the surface at the rate of 5 lb. to 30 square yards, and in the case of light soils substitute bone flour for the slag. It is also necessary to ensure that the soil contains sufficient lime. In spring, a week or two before planting, apply sulphate or muriate of potash at the rate of 2 lbs. to 30 square yards, and in the case of poor soils a light application of sulphate of ammonia may be given along with the potash. If the soil is rich the sulphate of ammonia is better to be withheld at this stage, and used if necessary during the summer as a top-dressing to stimulate the growing crop.

Times of Sowing.—For small onions, to pull green for salad purposes in spring and early summer, seed of the White Lisbon variety may be sown from the middle to the end of July on ground that has been cleared of early potatoes or other summer crop. Simply tramp the ground firm and rake it level before sowing. Sow thinly, and no thinning will be required until the strongest plants are pulled for use in spring.

To obtain plants for growing on into large bulbs make a sowing in the third week of August (the 18th to the 20th) in the north, and in the southern counties about ten days later; the plants to stand all winter in the seed-bed and be planted out the following

spring. The best dates on which to sow will vary somewhat in different localities. But the aim should be to avoid sowing too early, thus producing overgrown plants that would be liable to run to seed the following season, or, on the other hand, too late sowing and weak plants that will not survive the winter, or, if they do survive, will be unfit for planting at the proper time.

In spring, onions may be sown thinly in boxes under glass early in February, and be grown on near the glass in a moderate temperature for April planting; or sow about the same time in a cold frame. In either case the plants must be well hardened off before planting out. Failing facilities of this kind, it is necessary in the north to purchase plants so raised. In the southern counties, however, good results are obtained by sowing out of doors in spring and in the ground where the crop is to mature.

How to Sow.—When sowing in August the seed-bed should be tramped firm and then raked level. Sow in shallow drills 8 inches apart, and allow the plants to stand, without thinning, until planting in spring. When sowing outside in spring where the crop is to mature, consolidate the soil by tramping or rolling, afterwards rake the surface, and sow in shallow drills 8 to 10 inches apart. Cover in the seed, and as soon as the young plants appear, hoe between the rows to loosen the surface soil. Later, when the plants are strong enough, thin to 6 or 7 inches apart.

Transplanting.—The ground should be firmed and raked level for transplants, on the above lines. When transplanting from seed-bed, frame, or box, water the plants thoroughly a few hours before lift-

ing. Lift carefully and plant out 10 inches between the rows and 7 inches between the plants. Avoid planting too deeply. The holes should be deep enough to allow the roots to be placed straight down in their natural position, making them quite firm in the soil, but the base of the stem should only have a grip of the surface of the soil sufficient to keep the plant in an upright position until fresh roots are formed.

After-treatment.—From the time fresh growth commences onwards, hoe frequently between the rows, water when necessary, dust occasionally with soot, and from the time the bulbs are half grown apply periodically weak liquid manure, or give a light dressing between the rows of sulphate of ammonia, hoeing it into the soil. It is usually from about the middle of July, when the growth tends to slow down, that a mild stimulant at intervals is most beneficial in increasing the weight of the crop.

Ripening and Storing.—About the end of August withhold feeding, and use means to encourage the ripening of the bulbs. The keeping qualities of onions depend in a large measure on their being well ripened off, and this is best accomplished by taking a digging fork or spade and inserting it a few inches underneath the bulbs, raising them well up so as to break the roots and reduce the flow of sap and water to the plants. At the same time bend the stems over to a horizontal position, without breaking or twisting them, and leave the plants partially out of the soil for a time. When the tops turn yellow pull the plants, shake them free of soil, and spread them out on a mat or hard surface to dry in the air

for a week or two. Afterwards, when quite dry and firm, trim off the roots and leaves, retaining only 2 or 3 inches of the stems; tie the bulbs into bunches, and hang them up in a cool, airy place indoors where they are safe from frost. Except during frost a free circulation of air is an essential for keeping onions. Any bulbs that are blemished, and those that are soft round the base of the stem, should be kept by themselves and used first; the bulbs that keep longest are those that are sound and quite firm up to the stems, and these are not always the largest specimens.

The following are good varieties: To sow in July for spring pulling, White Lisbon. To sow in August for spring planting, Globe Tripoli and Giant Rocca. To sow in spring, Cranston's Excelsior, Bedfordshire Champion, Ailsa Craig, and Rousham Park Hero—the two first being excellent keepers.

Shallot.

Botanical Name: *Allium ascalonicum.*
Natural Order: *Liliaceæ.*

The shallot is a native of Palestine, and has been in cultivation from a very remote period. It was first introduced into England in 1548, and since then it has been extensively grown.

Soil and Manures.—A medium soil is best adapted for this crop, and should be deeply dug in early winter and laid up to the weather. A good plan is to grow shallots on ground that was liberally manured for a previous crop. Avoid digging-in farmyard manure in winter unless the soil is poor,

when a dressing of short or decayed manure may be dug in, mixing it with the top spade depth. After digging and in spring apply the fertilisers advised for onions, and give a dusting of soot to the ground either before or after planting.

Culture.—Shallots are usually increased by division of the off-sets, or cloves; and after lifting the crop each summer, medium sized, firm specimens should be selected for planting the following spring.

Early in March firm the ground and rake it level; set the line and plant the bulbs in rows 1 foot apart and 8 to 9 inches between the bulbs in the rows. They should be inserted so that the apex is just above the soil level. Hoe frequently between the rows during summer; and early in August, when the leaves turn yellow, lift the bulbs, shake them free of soil, and spread them out on sacks or in shallow boxes to dry in the sun, taking them indoors at night or during damp weather. When well ripened place in shallow boxes or in nets, and store in a dry, airy place indoors.

Giant Red is one of the best varieties.

Leek.

Botanical Name: *Allium porrum.*
Natural Order: *Liliaceæ.*

The leek has been cultivated and used as food from very ancient times, and its native habitat is uncertain. It appears to have been grown in this country for several centuries.

Soil and Manures.—Leeks may be successfully grown in any good garden soil that is deeply worked

and liberally manured. Like the onion, this crop thrives best in soil containing an abundance of humus. The ground should be prepared and manured on the same lines as advised for onions.

Sowing and Planting.—If early leeks are wanted, for use in late summer, seed may be sown in boxes under glass in February, or in a cold frame, and the plants put out when strong enough, after being well hardened off. The main-crop leeks for winter use should be sown out of doors from the middle to the end of March, in a well-prepared seed-bed; sow in shallow drills 8 inches apart. From the middle of May to the end of June level the ground intended for leeks, and draw drills 15 inches apart and about 3 inches deep; plant in the bottoms of these drills, using a dibber to make the holes. The plants should be let in up to the base of the leaves, pressing a little soil down on the roots but otherwise leaving the holes open. From 6 to 8 inches is a good distance to allow between the plants. If the weather is dry at the time, besides watering the seed-bed before lifting the plants, puddle the roots in a thick mixture of soil and water before planting. Hoe regularly between the rows; and as growth proceeds the soil is gradually filled into the drills around the plants, thus securing a greater length of blanched stem. When ground is specially prepared for leeks in winter, a crop of early carrots, spinach, or radishes may be taken from it before it is wanted for planting, sowing these in early spring.

In order to economise ground, particularly in small gardens and allotments, instead of reserving ground for leeks, a good plan is to make these follow early

cabbages planted in autumn, early peas, early potatoes, etc., and sow the leeks at the end of March, to be planted out gradually, as ground becomes cleared up, to the third week in July. In this case, when the first crops are removed, dig the soil deeply, turning in any decayed manure or vegetable refuse that may be available, and applying on the surface a dressing of sulphate of ammonia.

Dig the leeks as required during autumn and winter; but when the ground is needed for the winter operations they may all be lifted and stored in a trench, as advised for parsnips.

Good varieties are: Musselburgh, The Lyon, and Carentan.

Turnip.

Botanical Name: *Brassica rapa.*
Natural Order: *Cruciferæ.*

The turnip has been cultivated from a very early period, and is said to be a cultivated form of the common wild turnip which is indigenous to Europe, including Britain. It is usually referred to as a root crop, but is included here because of its manurial requirements, and the fact that it responds best to the same treatment in that respect as do the foregoing crops.

Soil and Manures.—Turnips of the best quality are grown on a medium to a light soil, of a fairly rich nature. Dig the ground deeply in winter, applying a moderate dressing only of farmyard manure, more if the soil is poor. Supplement this later with fertilisers on the lines recommended for the onion

crop. It is essential that there be a plentiful amount of lime in the soil.

Sowing and Thinning.—In the southern counties sowing may commence about the middle of March, while farther north the middle of April is quite soon enough most seasons. Continue to sow for succession every four weeks up to July. At first sow early sorts, followed in June and July by Golden Ball for autumn produce. This variety will stand in the open ground late in the year, or it may be lifted and stored. A sowing of Early Snowball or Early White Stone may be made at the end of July in the north, or during August farther south, on cleared potato ground.

The ground should be in a fine, free condition. Rake the surface level and draw drills about 1 inch deep and 12 inches apart for early varieties, allowing 15 inches for strong growers, such as Golden Ball. In each case thin out the seedlings to 6 inches apart. The after-treatment simply consists in frequent hoeing between the rows, and keeping the ground clean. In the last week of May in the north, and ten days later farther south, a fairly large sowing of a good garden swede turnip may be made in well-manured soil, allowing 18 inches between the rows, and thinning out the plants later to 8 inches apart. These should be lifted and dressed in November, and stored or pitted for winter and spring use.

The following are good varieties of turnips: Early Snowball, Early White Stone, White and Purple Milan, and Golden Ball. Also Laing's Swede, or any improved garden swede of good quality.

Celery.

Botanical Name : *Apium graveolens.*
Natural Order : *Umbelliferæ.*

The celery plant is a native of Europe. It appears to have been cultivated in this country for about three hundred years. It is a moisture-loving plant, but succeeds best in a free, warm soil.

Culture.—Sow in boxes under glass early in March, and when the seedlings are strong enough, transplant them into other boxes, 3 inches apart each way, in good compost. Grow on steadily in a moderate temperature, and towards the end of April place the boxes in a cold frame, to harden the plants off gradually before transplanting them into trenches. The trenches should be prepared some time in advance, each trench being made 2 feet wide, and the soil 1 foot deep taken out and placed along each side. Dig over the bottom of the trench, working-in a thick layer of decayed manure, mixing it well with the soil. Place above this about 5 inches of the surface soil, and then apply a good dressing of basic slag or steamed bone flour, along with a potash fertiliser. Wood ashes, if available, may also be added. Rake the ashes into the soil and leave until planting time. Planting may be done from the middle to the end of May if the weather is favourable, otherwise leave it over for genial conditions. Tramp the bottom of the trench lightly to firm the soil and manure. Plant two rows 12 inches apart and 6 inches from the sides of the trench, allowing about 10 inches between the plants in the rows. In shallow soils

7 to 9 inches only need be excavated in the first instance. After planting, give a dusting of soot to the soil around the plants. Water the plants before removing them from the boxes, and they should never afterwards be allowed to become dry at the roots. When watering is needed, give a thorough soaking, and avoid frequent waterings. Feed with weak liquid manure when the plants are growing freely, and apply periodically a light dusting of sulphate of ammonia. When about 16 inches high tie the plants up loosely, remove suckers, and earth up. Earth up again when a few inches of further growth is made, and again in autumn before severe frost. Prevent soil getting into the centres of the plants. Good varieties are: Red-Grove Red, and Standard Bearer; White-White Gem, and Sandringham White.

Pests and Diseases.

Onion Fly (*Phorbia cepetorum*).—This fly lays its eggs at the base of the onion leaves, and the maggots which hatch out tunnel into and destroy the bulb, the foliage turning yellow.

Treatment.—(1) A steady, vigorous growth is important; water copiously in dry weather, and feed as advised in onion culture. (2) Dust freely with soot over the bed, but particularly round the base of the plants. (3) The soil may be drawn away from the bulbs and a liberal dusting of hellebore powder given. (4) If preferred, spray the bed once or twice a week with a paraffin emulsion. (5) Promptly dig up and burn infested plants.

Onion Mildew (*Peronospora Schleideni*).—This dis-

ease occurs first in the form of yellowish patches, and later as a white mould, on the leaves. The leaves shrivel and the growth of the bulb is arrested.

Treatment.—(1) Promptly pull up and burn affected plants. (2) Dust surrounding plants, or the entire crop, heavily with powdered quicklime and sulphur, in the proportion of 1 of lime to 2 of sulphur, when the foliage is moist. (3) Spray with a solution of liver of sulphur (sulphide of potassium), at the rate of 1 oz. in 2 gallons of water.

Turnip Flea Beetle (*Haltica nemorum*).—This pest attacks the seedlings immediately they appear above ground. It is popularly known as the "Turnip Fly," and feeds on the seedlings in the adult insect state.

Treatment.—(1) Hasten the plants into the rough leaf by good cultivation, as already advised. (2) As soon as the seedlings appear, dust along the rows with lime and soot.

Turnip Sawfly (*Athalia spinarum*).—The larvæ of this pest attack the young plants at a somewhat later stage in their growth. They are white at first and gradually turn dark in colour.

Treatment.—(1) Stimulate rapid growth by means of a nitrogenous fertiliser, watering it in. (2) With a birch broom detach the caterpillars from the leaves, when they will be unable to regain their position. (3) Dust the foliage with lime and soot, or with hellebore.

Club Root (*Plasmodiophora brassicæ*).—This disease, also known as Finger and Toe, frequently attacks turnips. For treatment, see under GREEN CROPS.

Celery Fly (*Acidia heraclei*).—This insect attacks

both the celery and the parsnip. It appears in late spring and early summer, and deposits its eggs on the under surface of the leaves. The resulting larvæ bury themselves in the tissues, and tunnel along, forming passages and large blotches in the leaves.

Treatment.—(1) Force rapid leaf growth, and dust freely with lime and soot, or hellebore, on the under surfaces of the leaves as well as above. (2) A spray once a week with paraffin emulsion may be given. (3) Trace the larvæ, and kill them by pressing them between thumb and forefinger.

Celery Leaf Rust (*Septoria petroselini*).—This disease attacks the leaves of celery, and sometimes parsley, in the form of brown rusty patches. It spreads quickly, and if not checked, seriously injures the crop.

Treatment. — Encourage vigorous growth, and promptly collect and burn all diseased material. Afterwards spray the foliage with Bordeaux Mixture, as recommended for potato disease.

CHAPTER IX.

MISCELLANEOUS CROPS.

THE foregoing chapters have dealt with the more popular and important vegetable crops found in practically all gardens, large and small alike, and by the cultivation of which it is possible to maintain a regular, adequate, and varied supply of vegetables throughout the whole year. These crops being classified on a rotation or manurial basis, each chapter included those vegetables requiring similar soil preparation and manuring.

There is, in addition, a considerable number of what may be termed less essential vegetables and herbs, usually grown in large gardens, and some of the more useful of them also find a place in small gardens and allotments. These, however, can only be considered as complementary to the more important vegetable crops. A selection will now be dealt with, but the scope of this book will only permit of a short reference being made to each, and a summary, in as few words as possible, of the main cultural points.

Asparagus.

Botanical Name: *Asparagus officinalis.*
Natural Order: *Liliaceæ.*

This plant is a native of Europe, and has been in cultivation since very early times.

Culture.—Asparagus prefers a medium, loamy soil, heavily manured. Mark off the bed to be sown or planted 4 feet 6 inches wide, with an 18-inch alley along one or both sides. Trench the bed 2 or 3 feet deep in early winter, working into the upper 2 feet liberal quantities of farmyard manure. Throw 3 inches of soil from the alleys on to the bed, and rake or fork into the surface soil basic slag or bone meal, then allow to settle until spring. In March give a dressing of potash, and dust with lime, or apply, if available, powdered lime rubble or old plaster. Early in April rake very fine on the surface, removing the stones, and draw shallow drills for the seeds. Sow three rows in the bed, 18 inches apart and 9 inches from each side. Sow thinly and cover in, leaving the surface quite level. When the plants are well up thin them out to 7 inches apart in the first instance, and hoe frequently between the rows during the summer, watering copiously in dry weather. Clear off the withered stems in autumn, and apply a mulch of decayed manure. The following spring rake off the rough portion of the manure, and apply a dressing of salt at the rate of 2 lbs. to 30 square yards. In April every alternate plant must be removed, and may be used to fill up blanks previously marked with sticks, or for the formation of another

bed, planting at 14 inches apart. This is quite close enough for the permanent plants. The after-treatment consists in keeping the beds clean, and the removal of withered material in autumn; applying basic slag or bone flour every second winter, and potash and sulphate of ammonia every spring along with a light dressing of salt. An occasional dusting with soot is also beneficial. A mulch of decayed manure, applied as above indicated, need be given only once in two or three years, unless the soil is poor. No cutting should be done until the third year after sowing. If well made in the first instance, an asparagus bed will last a large number of years with proper treatment.

Reading Giant and Connover's Colossal are good varieties.

Celeriac.

Botanical Name: *Apium graveolens rapaceum.*

This is a turnip-rooted variety of ordinary celery, and is grown for the swollen root or knob. The roots keep well when stored in the autumn, and make a useful contribution to the winter supply of vegetables.

It requires to be sown in boxes, and brought on like ordinary celery for planting out in May or early in June. The ground must be deeply dug and well manured. Plant out 18 inches between the rows and 12 inches between the plants. Hoe frequently, and water freely in dry weather. Apply a dusting of sulphate of ammonia two or three times during the

season, and soot may also be used. Lift in November and store as advised for parsnips.

Chives.

Botanical Name : *Allium schœnoprasum.*
Natural Order : *Liliaceæ.*

This plant is a native of Europe, and is extensively grown for flavouring soups, salads, etc. It will thrive in almost any kind of soil and position, and is usually grown as an edging. Chives are propagated by division of the roots in March, and the small clumps, or divisions, should be planted 6 inches apart, and if in rows allow 12 inches between. Lift, divide, and replant every third year. When wanted for table use, cut the leaves close down with a knife.

Couve Tronchuda.

Botanical Name : *Brassica oleracea costata.*
Natural Order : *Cruciferæ.*

This is a variety of cabbage grown for the fleshy white midribs of the outer leaves, which are first cooked for use; and the hearts, which are similar to the ordinary cabbage, are used later. Sow early in April in a seed-bed and transplant when strong enough into rich soil, 30 inches apart each way. Otherwise cultivate like main-crop cabbages.

Gourd, or Pumpkin.

Botanical Name: *Cucurbita maxima.*
Natural Order: *Cucurbitaceæ.*

The cultivation of this plant is the same as that of Vegetable Marrows, to be dealt with later.

Varieties: Mammoth, Large Yellow, Large Green, and Spanish Giant.

Indian Corn, or Maize.

Botanical Name: *Zea Mays.*
Natural Order: *Gramineæ.*

This is a native of America, and in warm countries it is extensively grown as a corn crop and also as a vegetable. In this country the cobs are gathered and cooked entire when young and tender, or, when allowed to become more mature, the seeds may be taken off and cooked.

Culture.—Seeds may be sown in boxes under glass early in April, and grown on in a moderate temperature. From the middle to the end of May, harden off the plants and plant out 20 to 24 inches apart each way in fairly rich soil, and in a warm, sheltered position. Where no glass is available plant the seeds out of doors, early in May in the south and towards the end of May in the north. The ground should have been dug and manured, and received a dressing of phosphates. Rake level, and dibble in the seeds 2 inches deep, 24 inches between the rows, and 10 inches between the seeds in the rows. When up and growing freely, every alternate plant must be

removed and used to fill up vacancies or be transplanted elsewhere—between the rows of peas, etc. Hoe frequently, and water heavily in dry weather.

Varieties: Quarantain, and Early Dwarf for raising under glass.

Jerusalem Artichoke.

Botanical Name: *Helianthus tuberosus.*
Natural Order: *Compositæ.*

This plant is a native of America, and is believed to have been introduced into Europe in 1617. The tubers form an excellent winter vegetable, and are very nutritious. A medium soil suits it best, and in winter the ground should be deeply dug and receive a moderate dressing only of farmyard manure, supplemented by an application of phosphates and potash. Plant medium-sized tubers in March, 30 inches between the rows and 14 inches between the sets, in drills 5 inches deep. Earth up very slightly when the plants are 7 inches high, and otherwise the cultivation is the same as for main-crop potatoes. Dig as required for use the following winter, or lift and store like potatoes or beet.

There are two sorts, the White and the Purple.

Kohl-Rabi.

Botanical Name: *Brassica oleracea, Caulo-rapa.*
Natural Order: *Cruciferæ.*

The origin of this plant is uncertain. It has been derived from the wild cabbage and is intermediate between a cabbage and a turnip, being grown for

its swollen, fleshy stem, which is cooked in the same way as a turnip.

Culture.—Kohl-Rabi can be well grown in any good garden soil, prepared and manured as for turnips. Sow in a seed-bed early in April, and when the plants are strong enough plant out 15 inches between the rows and 12 inches between the plants. Hoe frequently, and use the crop when in a young, succulent condition, from the time the plants are half grown onwards.

Mint.

Botanical Name : *Mentha viridis.*
Natural Order : *Labiatæ.*

This particular variety, known also as spearmint, is extensively grown and used for culinary purposes. It is a plant of great antiquity, and has been in cultivation from very early times.

Culture.—Mint is propagated by division, preferably in March. It succeeds best in a rich, moist soil, medium to heavy in texture. Plant the roots 2 inches deep, and about 9 inches apart each way. A plantation will last for several years if the stems are cut off close to the ground every autumn and a thin layer of decayed manure or rich soil placed over the plants.

Parsley.

Botanical Name : *Carum petroselinum.*
Natural Order : *Umbelliferæ.*

This is a plant of ancient repute and cultivation. It is a native of Sardinia.

Culture.—Parsley succeeds best in a rich, moist soil, medium to heavy in texture. It may be grown in separate beds, or along the edges of vegetable breaks. No rank manure should be used; but decayed manure, vegetable compost, or rich soil may be dug in. To maintain a supply, sow three times, in March, May, and July. Sow thinly in shallow drills about 15 inches apart, and thin the seedlings early to 6 inches apart in the rows. Suppress flower stems, and in early autumn cut off the old leaves from the first sowings, to induce the plants to make fresh growth.

Varieties: Dwarf Perfection, Giant Curled, and Myatt's Garnishing.

Purple Sprouting Broccoli.

This vegetable is grown for the sake of its purple sprouts. It requires the same cultivation as hearting broccoli.

Rhubarb.

Botanical Name: *Rheum hybridum.*
Natural Order: *Polygonaceæ.*

This is a native of Central Asia, and was first grown as a vegetable in this country in the sixteenth century. Rhubarb can be well grown in any good garden soil, if not too light and dry. Trench deeply and manure heavily in the top two spade depths. It is best propagated by division of the roots, each division with one or two good buds or crowns attached. Plant from November to February, 2½ feet apart each way, and so that the crowns are 2 inches

beneath the surface of the soil. In after years fork in a quantity of manure between the roots in winter, and apply a dressing of sulphate of ammonia once or twice in spring and early summer. It is a good plan to lift, divide, and replant the roots every five years or so.

Good varieties are: Linnæus, Daw's Champion, Champagne, and Victoria.

Salsafy.

Botanical Name: *Tragopogon porrifolius.*
Natural Order: *Compositæ.*

Scorzonera.

Botanical Name: *Scorzonera hispanica.*
Natural Order: *Compositæ.*

These two plants are grown for their long fleshy tap-roots, which are useful winter vegetables. Sow from the middle to the end of April in drills 1 inch deep and 12 inches apart. Thin out the plants gradually to 8 inches apart. Hoe frequently and remove any flower stems as they appear. Otherwise prepare and manure the ground, and afford the same cultural treatment as advised for beetroot. Lift the roots in November and store like beet.

Spinach.

Botanical Name: *Spinacea oleracea.*
Natural Order: *Chenopodiaceæ.*

This is an excellent vegetable, and one that deserves to be more extensively grown. It succeeds in any

good garden soil that is well manured. Seed may be sown towards the end of March, and for succession about every three weeks up to June. Sow in drills 1 inch deep and 1 foot apart, thinning the plants to 4 inches apart when large enough. Hoe frequently, and water freely in dry weather. Spinach is very suitable to use as an inter-crop between the rows of peas and other slow-growing crops. It responds readily to weak liquid manure.

About the third week in August, ground cleared of early potatoes, etc., should be forked over and raked level, and then sown with spinach for winter and spring use. Sow and thin as above, making a second sowing about the middle of September. These two sowings will give produce at intervals during winter, and in greater abundance after active growth starts in spring up to the end of April or May, when the plants are liable to run to seed and must be dug up to make way for another crop.

Spinach Beet.

This plant is grown for its succulent green leaves, which it produces in abundance under good cultivation, and which may be used like ordinary spinach. The white midribs may be cooked by themselves similarly to asparagus.

Sow in early April in drills 15 inches apart, and thin the plants later to 8 inches apart, to provide a supply during late summer and autumn. The plants are hardy and may be left in the ground to produce leaves the following spring, until they begin to run to seed, when they must be dug up. Another

method is to make a sowing in August to provide a spring supply.

Vegetable Marrow.

Botanical Name: *Cucurbita Pepo onifera.*
Natural Order: *Cucurbitaceæ.*

The vegetable marrow is a native of Persia, and it has long been cultivated in the East. The time of its introduction into this country is unknown with certainty.

Culture.—The plant will thrive in any free, rich soil if supplied with plenty of moisture at the roots. Sow the seeds singly in small pots early in April. It is a good plan to soak the seed in water for a few hours before sowing. Use a sandy compost, and after the seedlings appear keep them well watered. When the pots are nearly full of roots shift the plants into a larger size, potting them fairly firm in a rich compost. Grow them on in a moderate temperature and near the glass, to induce close-jointed, sturdy growth. Harden the plants off, and plant out about the end of May or first week in June.

Marrows may be planted in the open ground or on the top of a compost heap. In either case a fairly large hole should be made and filled to within a few inches of the top with decayed manure and soil mixed. Place 6 inches of plain soil above this, in which to insert the plants. A few hours before planting soak these prepared sites with water, and also the plants in the pots; plant firmly, being careful not to break the roots; cover the moist soil with a thin layer of dry material to prevent evaporation,

and avoid further watering for several days until fresh roots are formed. For at least a week after the plants are put out they should be protected against hot sunshine, cold winds, and low night temperatures. When the main shoot is 2 to 3 feet long pinch off the growing point to induce it to break freely into side shoots; and later, if any shoot grows away much in excess of its neighbours, check it in the same way. Otherwise allow the plants to wander freely, provided they are not overcrowded when thinning out the shoots becomes necessary. Keep the plants well supplied with water, and after a number of fruits are formed, use for the purpose very weak liquid manure. Marrows are in the best condition for cooking before they are quite ripe; but in autumn ripe specimens may be hung up in a dry, airy place indoors, where, if safe from frost, they will keep for a considerable time.

Good varieties are: Perfection, Pen-y-byd, Long White, and Long Green. Tender and True and White Bush are two good varieties of the compact-growing bush class.

CHAPTER X.

GENERAL ITEMS.

Soil Pests.

THE following insect pests are general feeders, and do not confine themselves to any particular crop or kind of vegetable.

Wireworms (*Agriotes lineatus*).—The wireworm is the larval stage of the skip-jack or click beetle. It is about 1 inch long, of a brownish-yellow colour, and is furnished with six legs, one pair on each of the first three segments and a swelling on the lower surface of the terminal segment. It continues in the larval stage from three to five years, feeding all the time.

Leather-jackets (*Tipula oleracea*).—The leather-jacket is the caterpillar of the crane fly or daddy-long-legs. It is about an inch long, of variable colour, but generally brownish, and the head is black. It has no legs, and the tail end, which is cut square, is furnished with several tubercles.

These two pests are ravenous and indiscriminate feeders, being liable to attack the roots of all kinds of vegetable crops. They are usually abundant in land which has been under grass for some time, and

in taking in fresh ground all the turf should be buried and rotted down the first year, to avoid harbouring the pests and carrying them over to another season. The same remedies apply equally to both insects.

Treatment.—(1) Apply a liberal dressing of freshly-burnt lime in winter—not that lime kills the pests, but it hastens the decay of grass roots and other materials on which they feed. (2) Dig in naphthalene as a soil fumigant. (3) Apply a liberal dressing of superphosphate before sowing or planting, and also use sulphate of ammonia. These fertilisers have the double effect of driving off the pests and inducing a strong, rapid growth in the crop. (4) Carbon-disulphide may be used as a soil fumigant in spring before planting or during the growing season, so long as it does not come into direct contact with the roots of plants. The fumes of this substance are heavier than air and penetrate downwards into the soil, so that it need only be placed near the surface. A good plan is to fill a clean oil-can with the chemical; make a large number of small holes—two or three to each square yard—3 inches deep; squirt a few drops of the carbon-disulphide into each hole, and immediately fill up with soil. It must be remembered that this substance is both poisonous and very inflammable.

Surface Caterpillars (*Agrotis* sp.).—These caterpillars attack the plants at, or just below, the surface of the soil. They attack nearly all garden crops, but are particularly destructive to green crops.

Treatment.—(1) Promote a strong, rapid growth in the plants by the use of sulphate of ammonia. (2) Soot, or soot and lime mixed, placed round the

plants and lightly hoed in, gives good results; also waste carbide of calcium. (3) Sand or fine soil mixed with paraffin or naphthalene and similarly applied. (4) Frequent hoeing of the soil between the plants, and killing any caterpillars brought to the surface.

Suppression of Weeds.

Weeds, if allowed to grow, rob the soil and the crops of much valuable food material and moisture; prevent the free circulation of light and air; and many of them are agents for the harbouring of insect pests and diseases. Perennial weeds should, as far as possible, be dug up as they make their appearance during the growing season; and in autumn, as soon as the crops are cleared off, the ground should be forked over, removing carefully all roots of these weeds, even small pieces, which, if allowed to remain, would grow the following year. Annual weeds must be kept down by regular hoeing and weeding, and should never be allowed to produce seed. This they do very quickly, especially in late summer and early autumn, and if allowed to remain they distribute immense numbers of seeds, which cause much extra work in subsequent years as well as injury to the crops. Freedom from weeds adds greatly to the appearance of all garden ground; it benefits both soil and crops; and undoubtedly the best and most satisfactory way to keep weeds down is never to allow them to get up.

The Use and Abuse of Water.

During periods of dry weather many cultivators are tempted to water crops frequently, and this is often done to the detriment of the plants, or done in such a way that it is ineffectual. Too frequent watering is distinctly injurious, as it constantly chills the soil and the roots of the plants, and often retards rather than facilitates growth. For, if water is frequently applied in copious quantities, the soil and the roots are prevented from becoming properly warmed, available plant foods are liable to be washed down beyond the reach of the crop, and the manufacture in the soil of further supplies is reduced. On the other hand, frequent driblets of water—sufficient only to wet the surface soil—are even more futile, assuming that watering is necessary. This unpractical method chills the plants and the surface soil, while the roots lower down may remain in quite a dry condition.

As a rule, established well-rooted plants are better not watered, and it is unnecessary so long as they remain healthy and continue to grow steadily. When watering is required—as is most often the case with recently planted crops and seedlings, and certain moisture-loving vegetables—the soil should be thoroughly soaked at one operation down to and beyond the depth of the roots, afterwards thinly covering the wet surface with dry soil to prevent evaporation of the water, or frequently hoeing the surface soil to secure the same result. This in most cases renders further watering unnecessary. A liberal soaking, and

afterwards using means to conserve the water in the soil, is infinitely better from all aspects of the subject than frequent waterings.

Intensive Cropping.

Both from an individual and a national aspect, well-cropped gardens and allotments are a valuable asset; and if they are to contribute their full and proper share to the food supplies, more systematic cultivation and cropping must be practised than has been hitherto the rule. There must be intelligent anticipation for many months ahead, so that the interval of time between crops during which the ground is allowed to lie idle may be as short as possible, and that throughout the growing season it may be cropped to its utmost capacity. There can be no doubt that allowing land to lie idle for an unnecessarily long period, or cropping it insufficiently at any time, means a distinct loss to the owner; for not only are the crops lost that it ought to yield, but there is liable to be considerable wastage of valuable plant foods during periods of heavy rainfall, when they may be washed down to the subsoil or to the drains, particularly in the lighter soils.

By intelligent soil management and manuring, and the selection of suitable kinds and varieties of vegetables, sown and planted at appropriate times, it is possible to increase largely the productivity of the land, and to ensure a constant supply of valuable food crops at all seasons. This can be accomplished in anything approaching a maximum degree only

when cultivators—large and small alike—realise the ever-growing, cogent, and imperative need for improved and more intensive methods of cropping and the utilisation of every square yard of ground.

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